VOLUME 82 NUMBER 7

POWER

POWER TOPICS CROSS-INDEX

STEAM GENERATION
POWER GENERATION
WATER POWER
DIESEL & GAS ENGINES
AIR CONDITIONING & HEATING
REFRIGERATION
PUMPS & COMPRESSORS
STEAM SERVICES
ELECTRICITY & ELEVATORS
INSTRUMENTS & CONTROL
PIPING SYSTEMS
MECHANICAL TRANSMISSION
POWER MISCELLANY

N. O. WYNKOOP, *Publisher*
PHILIP W. SWAIN, *Editor*

Associate Editors
F. A. ANNETT
S. A. TUCKER

E. J. TANGERMAN, *Consulting Editor*

Assistant Editors
B. E. SAWYER
L. N. ROWLEY

PAUL WOOTON, *Washington* G. C. TENNEY, *San Francisco* H. S. KNOWLTON, *Boston*

JULY, 1938

Foreword—Why be an engineer? 45
Williamsburg installs new steam plant—no power outage .. 46
Hydraulic couplings make difficult starting easy 50
Old boilers learn new tricks—settings and watercooling 52
New York's Waterside Station installs its second "top" 54
Fuel of the future—it will be coal in the form of gas 57
New diesel plant, new cooling method for jacket water 59
Single-retort, screw-feed stokers—first of a stoker series ... 62
How to select and make use of diaphragm-motor valves ... 64
The arcronograph as an aid in grading welding operators .. 66
One boiler plant replaces two old ones at Sloane-Blabon .. 68
Water-wise refrigeration—balancing energy, water costs ... 72
Correcting the small defects improves elevator service 74
Questions and answers for the boiler-room engineer 75
Photostory—one of world's two largest cone valves 77
Data Sheet 71—Vacuum-column temperature correction ... 80
Power highlights at Germany's Leipzig Fair 81
Report on oil and gas power meeting at Dallas, Texas 82

DEPARTMENTS

Exhaust Lines 58
Engineers' Books 83
Power Lines 86
Practical Letters 90
New Equipment 98
Speaking of Power 76
Readers' Problems 84
Straws, New Construction 88
Current Comment 96
George Edwards 108

McGRAW-HILL PUBLISHING COMPANY, INC.
JAMES H. McGRAW
Founder and Honorary Chairman

Publication office: 99–129 North Broadway, Albany, N. Y.
Editorial & Executive Offices: 330 West 42nd St., New York, N. Y.

JAMES H. McGRAW, JR. President
HOWARD EHRLICH Executive Vice-President
MASON BRITTON Vice-Chairman
B. R. PUTNAM Treasurer
D. C. McGRAW Secretary
A. W. MORRISON Circulation Mgr.

CHICAGO, 520 North Michigan Ave.
SAN FRANCISCO, 883 Mission St.
WASHINGTON, National Press Bdlg.
PHILADELPHIA, 16 South Broad St.
CLEVELAND, 1510 Hanna Bdlg.
DETROIT, 2-257 General Motors Bldg.
ST. LOUIS, 455 Paul Brown Bldg.
BOSTON, 1427 Statler Bldg.
ATLANTA, 1105 Rhodes Haverty Bldg.
LONDON, Aldwych House, Aldwych, London, W C.2

Copyright, 1938, by McGraw-Hill Publishing Company, Inc.

POWER articles are currently indexed in both the industrial Arts and the Engineering Indexes, available at public libraries. Also every year POWER issues an annual index of its own. Cable Address: "McGraw-Hill, N. Y."

STANDARD OIL COMPANY'S

STANOCYL STEAM CYLINDER OIL

cuts oil consumption 86%

. . . at mill power plant

That's not a typographical error. 86% is right and the figure is taken from an actual record of oil consumption on a 650 H.P. Uniflow engine in the power plant of a midwestern cotton mill.

Records at this mill show that with a conventional cylinder oil the engine required approximately 54 gallons of oil during each 25 days of operation. When StanoCyl was used for the same period only 7¼ gallons were consumed.

StanoCyl has maintained this record for eight years at this mill. Consistently low maintenance costs during this time definitely prove the excellent lubrication provided by StanoCyl, even with this unusually low oil consumption.

There's a grade of StanoCyl to meet every operating condition. Let a Standard Lubrication Engineer recommend the grade you require and help you take full advantage of its cost-saving possibilities. Call this Lubrication Engineer at your local Standard Oil (Indiana) office or write 910 South Michigan Avenue, Chicago, Illinois.

Copr. 1938, Standard Oil Co.

STANDARD OIL COMPANY (INDIANA)

LUBRICATION ENGINEERING

THE RIGHT LUBRICANT • PROPERLY APPLIED • TO REDUCE COSTS

POWER

Established 1882 PHILIP W SWAIN, Editor

Why Be an Engineer?

ENGINEERING is a mighty poor field for half-hearted incompetents, but one of great opportunity and security for those who love machines and understand their ways. Here's why:

1. It is a socially essential occupation.
2. The future need for engineers is as sure as death and taxes.
3. The work is creative and logical, therefore a source of deep personal satisfaction to the proficient.

The first two reasons are closely related, because only essential jobs are truly safe in a world that is being reshuffled at an alarming rate. Political systems are in turmoil everywhere. Governments and national boundaries change overnight. The ultimate relation of capital and labor is still undecided. Even the so-called fundamentals of business and economics are the subject of endless argument.

Amidst all this confusion, everybody agrees that men must have food, clothes and shelter, and that a highly developed machine technique is essential to comfortable living. These are real fundamentals—not to be disputed by any sane man.

In view of the present world situation, we suggest a new motto for men who look ahead: "In times of stress and change, be an expert in the things that have got to be done." The real engineer is just that. Regardless of political and social changes, man will discover no way to live without machines. He cannot build and operate machines without engineers. The future of engineering is assured.

If engineering has an assured future, so has the individual engineer if he is competent and versatile. Versatility is just as important as competence. To stand firm in a world of change, it is not enough for the engineer to be a great expert on a single process or on some special design of boiler or steam engine. Machines we shall always have with us, but the particular machine or process may suddenly change its form or even disappear, replaced by something better. Some carriage builders became great automobile manufacturers. Others, lacking versatility, sank into oblivion.

Over-specialization is dangerous. The wise engineer stands ready at all times to shift his skill to the design or operation of entirely new types of machines.

For the greatest personal security, the versatility of the individual engineer should extend beyond his machines to embrace skill in human relations and the every-day operations of business. He must learn to live in a world of non-engineers. Products must be bought and sold. Money bags must be loosened for projects still in the dream stage. Workers must be led, managers adroitly "managed". Otherwise human failings will clog the gears of the most perfect mechanical plan.

Finally, as we have pointed out, engineering is a worthwhile career because its creative and logical work brings deep personal satisfaction to any man who likes to deal practically with machines, men and money.

To one who is cut out for the job, being an engineer means *living* 24 hours a day.

Production 100% — Power Outage Zero

New boilers and topping turbine installed on site of 30-year old boiler plant without interrupting production at Williamsburg Mill of W. Va. Pulp and Paper Co

By H C SCHRAMM
Plant Engineer

MAINTAINING steam supply for a paper mill running on a forced production schedule, all week every week, while replacing an old boiler plant with a completely new one was the job faced by the engineers of the Williamsburg, Pa. mill of the West Virginia Pulp and Paper Co, in the fall of 1936. Here's how they did it and what it looks like.

The original boiler plant, eight 1500-sq ft Heine boilers operating at 150 lb saturated, dates back to 1904. Later alterations included the installation of underfeed stokers, forced-draft fans, a separately-fired superheater, and two more Heine boilers, erected in another building and feeding the digester header. More recently, waste-heat boilers were built back of soda-recovery furnaces, generating 20-lb steam for pulp-mill process. Power equipment included a 3125-kva generator driven by a 140-lb condensing turbine, bleeding at 20 lb, and a 1500-kw condensing turbine.

Boiler efficiency on the main units (the two newer boilers were used as standby) averaged about 72%. Eleven men were required to operate the eight boilers, plus three coal-and-ash hands, barely enough when steam demand was heavy. Experience indicated that the boilers were nearing the end of the 25-30 year life that might be expected; life could not be prolonged by reducing pressure since original operating pressure was only slightly above process requirements. Accordingly, preliminary studies for a new boiler plant were made in 1931. A 600-lb and a 200-lb plant were compared and the then uncommon 600-lb plant appeared to be about 15-20% more costly. During the next four years various schemes were considered, but no action was taken.

The Situation in 1935

Early in 1935 things stood this way: 8 boilers were 31 years old, 2 were 29 years old, extensive tube replacements, costing more than $1200 per boiler plus labor, were required on three boilers, and tube sheets, already distressed, would be further injured by retubing. Settings would have to be rebuilt, stokers and coal-handling equipment needed complete overhauling, and power requirements were growing. A new steam supply was necessary and there were but two ways of getting it: (1) buy steam from a nearby utility standby plant with excess boiler capacity, or (2) build a new plant. With costs about equal, the need for continuity of service and possible increases in steam demand led to the decision to build.

Early studies had favored 250 lb, but load increases since 1931 swung the balance to 600 lb and 700 F, which

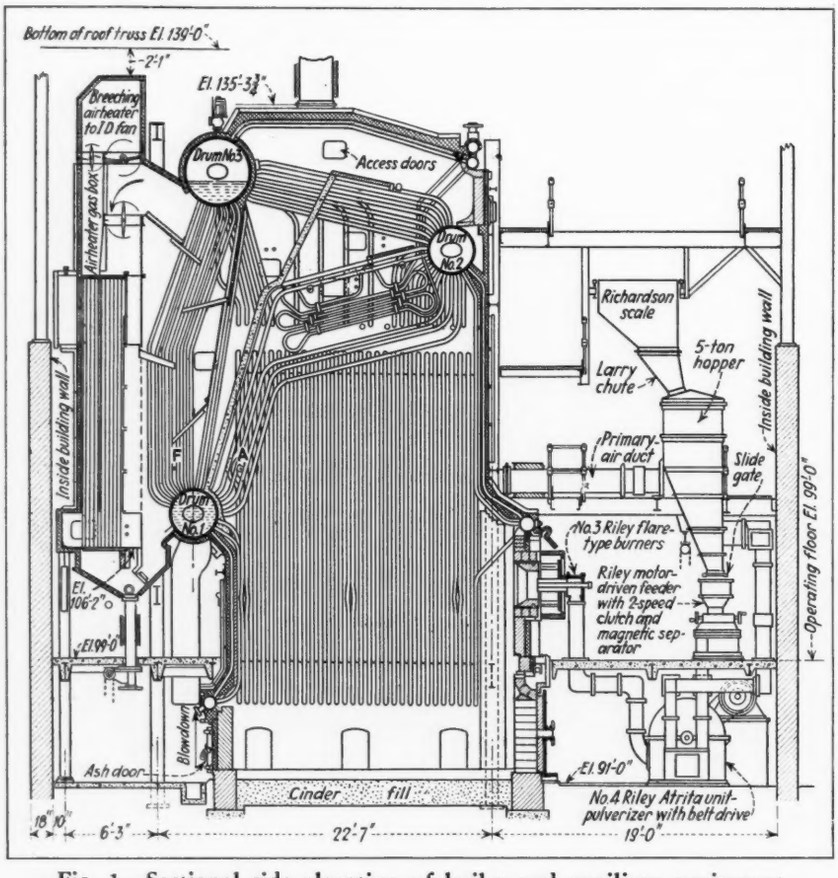


Fig. 1—Sectional side elevation of boiler and auxiliary equipment

TABLE I

ANALYSIS OF BIG SPRING WATER

	Raw	Treated	Aerated
Bicarbonate (HCO_3)...	151.3	—6.0*	12.2
Sulphate (SC_4).....	5.0	5.0	5.0
Chloride (Cl).....	3.0	3.0	3.0
Silica (SiO_2).....	13.0	9.0	9.0
Iron (Fe).....	0.05	0.05	0.05
Calcium (Ca).....	29.6	0.0	0.0
Magnesium (Mg).....	13.1	0.0	0.0
Sodium (Na).....	12.2	0.0	9.0
Total Dissolved Solids.	140.6	....	31.0
pH Value.....	7.6	....	7.0

*Methyl-orange acidity

since 1931 had become nearly standard practice. With a topping turbine, 600 lb met all projected power and process loads with minimum steam going to the condensers. A change from stokers to pulverized coal seemed to offer many advantages if no increase in flyash troubles resulted. Low combustion rates and scrubbers solved this difficulty. Low ash quantities led to the choice of a dry-bottom furnace; the ash obtained has been granular and easy to remove. Best of several choices seemed the installation of two boilers with only minor building alterations.

Designs were made with firing aisle, pulverizers and ash removal at old firing-aisle level but operations were interrupted by the 1936 St Patrick's Day flood. Water standing 4 ft deep on the firing floor made it seem wise to change the plans, raising the boilers. This was done; only pulverizers were left on the old level. Oil burners and oil-handling equipment were provided to maintain steam pressure for lights and power in the event of another flood of major proportions.

As completed, steam-generating equipment consists of two Riley-Badenhausen ring-circulation boilers equipped with water-cooled furnaces, superheaters, and air preheaters, Fig. 1. Test performance exceeded the 83% gauranteed. The back and side walls and upper front wall are all water cooled. Close spacing of side-wall tubes prevents ash-clinging; keeps the wall effective as a radiant heat absorber. Entire waterwall-pressure system is suspended; expansion is vertically downward and tubes are anchored to prevent lateral movement.

A steel-panelled, airtight, insulated casing sheathes the entire boiler above the foundation. Doors permit the use of lances above the slag-screen tubes. These have proved effective but do not remove slag from back tubes or soot from the rest of the boiler. Soot blowers were purchased and installed after the boilers had been in service.

Coal, received by rail, is unloaded to a hopper beneath the rails on an elevated trestle. A reciprocating feeder delivers coal to a 50-ton-per-hour ring-roll crusher. After reduction and screening, coal discharges to a conveyor elevator, which lifts to a 400-ton overhead storage bin. This cylindrical-shell bunker, welded throughout, is outside the building. Bitumastic compound on inside of bin and outside of conveyor housing protects against action of sulphur and water.

The bunker discharges to another conveyor-elevator which passes through the boiler house wall and rises, inside, to the top. A side-pull conveyor receives the discharged coal and carries it the length of the boiler house, unloading at three openings spaced over the three pulverizer-feed hoppers. At each discharge opening a track-mounted automatic coal scale records weight of coal going to the 5-ton feed hoppers.

Conveyor Operation

Coal not carried away from the elevator by the side-pull conveyor passes back through a spout to the return-chain casing and if feed hoppers are full, coal returns to the elevator through a 10-in. square casing. A device near the takeup on the horizontal conveyor indicates when coal is passing the tail end, signalling to stop the conveyors and elevator. Relation between conveyor and feed-hopper capacity is such that conveyors can be shut down at least half the time. In each hopper, a damper device starts the conveyor when coal reaches a low level and stops it when full. A low-level alarm indicates failure to start the conveyor or arching above the low-level device. Hoppers give about 2 hours supply.

Feeders are located at the firing aisle level with pulverizers in the basement. Pulverizers are Atrita units, one for each boiler and one spare. The fan in the pulverizer casing supplies about 10% of the air needed when operating at maximum coal capacity. This makes it possible to obtain a rich mixture of coal and air at all ratings and makes it easy to "light off" a fire and to carry light loads with good performance.

Two flare-type horizontal forced-draft burners are set "toed in" on each boiler. The complete unit, including head, windbox, and dampers, is installed entirely outside the front wall, not exposed to direct furnace heat. Each boiler is also equipped with two oil burners, each capable of developing 40,000 lb of steam per hr. Underground storage tanks hold a reserve of oil sufficient to insure normal paper mill operation during a flood similar to that of 1936. One fuel-oil pump is connected to the mill power system, one to utility lines. Both are above the 1936 flood stage.

One forced-draft fan supplies each boiler, and one induced-draft fan draws

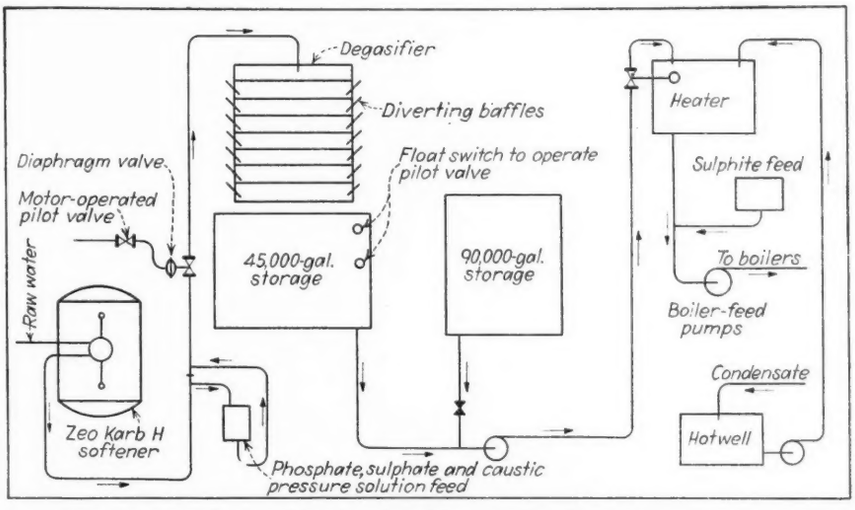


Fig. 2—Feedwater circuit, showing Zeo Karb treatment system

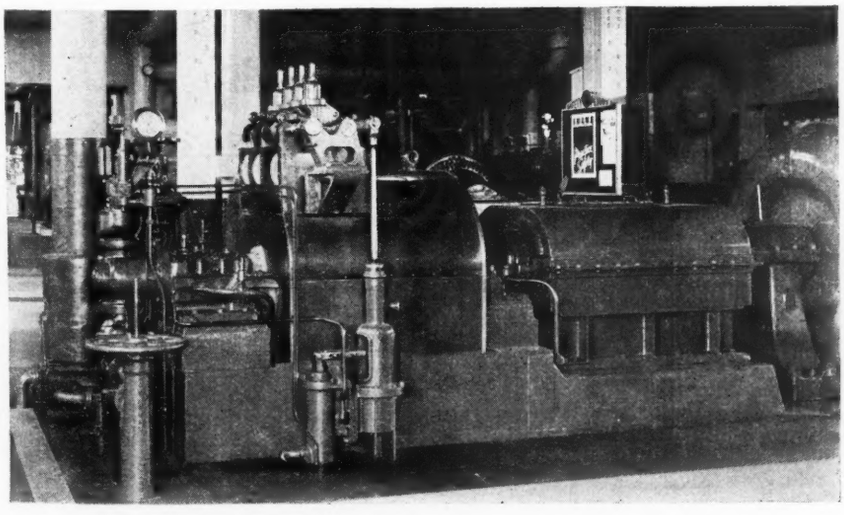


Fig. 3—Backpressure turbine driving generator through reduction gear

gas from both. These fans are 2-speed, driven by two motors, one located at each end of an extended shaft. A trial run on natural draft demonstrated that not enough steam could be made to run the plant, and led to the installation of a single-speed, 70,000-cfm emergency unit, discharging through a stub stack.

Gas flows directly from the rear of the furnace into a 2-pass tubular air heater. Plenum chambers at each end insure even distribution. Flow is down in first pass, up in second, discharging into a horizontal breeching fed by both boilers. A vertical duct leads down to the 4-section scrubber, which discharges through the induced-draft fan to a horizontal duct leading out of the building to a vertical duct and thence to the 150-ft brick stack. Interconnecting ducts with dampers make it possible to operate with or without air heater, or gas scrubber and on either regular or emergency draft fan. Boilers may be operated natural-draft without scrubber and air heater.

Chemical stoneware lines the steel casing of the scrubber and lead-covered rods hold the extruded-carbon plates. Normally, water from boiler-house service lines enters through a weir box above the plates. A float-controlled connection to the fire tank insures water in emergencies. Waste water is carried away by rubber-lined piping inside the building, and underground wood pipe outside. Dust recovery of 90% is claimed, with a draft loss of 0.6 in. at 70,000 lb of steam per hr.

Three sources of feedwater are available; mountain water from the Borough system, water from the Big Spring owned by the company and reservoir water from a spring owned by the Borough. Analysis of Big Spring water is given in Table I. Treatment used is Permutit Zeo Karb H; the arrangement of apparatus is shown in Fig. 2, and results in Table I.

Zeo Karb differs from other zeolites in that it can be regenerated with salt for the sodium cycle or an acid for the hydrogen cycle. On the H_2 cycle, bicarbonates are changed to carbonic acid which breaks up into water and CO_2, the gas being removed by aeration. Sulphates and chlorides change into corresponding acids. At this plant they are neutralized by caustic, sulphate and tri-sodium phosphate. Referring to the diagram, raw water percolates through Zeo Karb H in a rubber-lined tank, is neutralized and passes to the degasifier

Principal New Equipment—Williamsburg Mill

WEST VIRGINIA PULP & PAPER CO, WILLIAMSBURG, PA.

Steam-Generating Equipment:

Boilers, 2, 3-drum, bent-tube, 7400 sq ft.....Riley Stoker Corp
73,400 lb/hr, 580 lb, 700 F; No. 1 drum, 15 ft 10 in. x 36 in. I D x 1 7/16 in.; No. 2 drum, 17 ft 6 in. x 36 in. I D x 1 7/16 in.; No. 3 drum 17 ft 6 in. x 51 in. I D x 7 3/8 in. Seamless tubes, 256-3¼-in. No. 6 g, 246-2½-in., No. 8 g. Steam washer in No. 3 drum.
Superheater, convection high velocity, 18 element.....Riley Stoker Corp
Effective element length 92 ft, actual 110 ft; 2-in. O D, No. 9 g seamless steel; header 10⅜ in. x 1⅛ in., seamless, welded conn.
Furnace, 6200 cu ft, 16, 700 Btu/cu ft/hr release.....Riley Stoker Corp
Width 14 ft, depth 18 ft 9 in., mn ht 23 ft 6 in.; 3200 sq ft waterwall; 3¼-in. O D tubes, on 3 1/16-in. cc, at sides; on 7¼-in. cc, rear and upper front. Std. arch tile, 4-in. eff thickness, on upper front.
Air heater, 2-pass tubular, counterflow, 5500 sq ft.....Riley Stoker Corp
Boiler exit temp, 715 F; heater exit temp (gas), 470 F; entering air temp, 80 F; exit air temp, 420 F. 365 3¼-in., No. 13 g tubes.
Soot blowers.....Diamond Power Specialty Co
Boiler insulation.....Eagle Picher Lead Co
Refractories (American Arch Co, France Refractories)..Riley Stoker Corp
Boiler steel, operating floor, stairs and grating.....Riley Stoker Corp
Safety valves.....Consolidated Ashcroft Hancock Div
Superheater, 1½ in., 19,600 lb/hr at 595 lb; No. 3 drum, 2½-in., 40,600 lb/hr at 600 lb; 2½-in., 40,700 lb/hr at 610 lb; 3-in., 41,000 lb per hr at 618 lb.
Feedwater-regulating valves.....Republic Flow Meters Co
Feedwater control, mercury differential type....Republic Flow Meters Co
Water columns, Mica-sight, inclined.....Reliance Gauge Column Co
Non-return valves, with remote-closing trip valves..Golden Anderson Co
Blowoff valves.....Yarnall-Waring Co
Blowoff tank (manual).....Tippett & Wood
Continuous-blowdown system, with heat exchange.....Permutit Co
For 100,000 lb/hr. 60% makeup, 4% of makeup continuous. Flash tank 30-in. dia x 5 ft; rate of flow control box; plate heat exchanger to cool 1775 lb/hr from 259 to 90 F with 60,000 lb/hr of 60-F water.

Combustion Equipment:

Pulverizers, 3 (1 per blr, 1 spare), No. 4 Atrita.....Riley Stoker Corp
Pulverizer drives, 75 hp, 720 rpm sc motors
Westinghouse Elec & Mfg Co
Rawson pick-up coupling, V-belts and pulleys, WEMCO motor control
Feeders, horizontal table, magnetic separators.....Riley Stoker Corp
Feeder drives, ¾–1 hp, dc motors.....Westinghouse Elec & Mfg Co
500–2000 rpm, full-field control—clutch, countershaft, worm, and roller chain.
Feeder-motor rheostats, 62 point.....Cutler-Hammer Mfg Co
Coal burners, 2/blr, No. 3 flare type, No. 4 heads....Riley Stoker Corp
Fuel-oil pumps 2, 30 gpm, 130 lb. No. 3 oil.....Turbine Equip Co
1—3x2½ in. DeLaval IMO, 1450 rpm; 1—2½x2 in. DeLaval IMO, 1750 rpm.
Fuel-pump motors and control.....Westinghouse Elec & Mfg Co
1–5 hp 230 v, 60 cycle, 1750 rpm; 1–5 hp; 440 v, 25 cycle, 1450 rpm
Oil meters, 50 gpm, positive displ, osc piston.....National Meter Co
Oil burners, steam atomizing, 2 per blr.....The Engineer Co
Oil strainer, twin.....Elliott Co
Automatic combustion control, Smoot system....Republic Flow Meters Co
Control-oil pumps (1 steam, 1 motor).....Republic Flow Meters Co

Coal-Handling Equipment:

Track hopper reciprocating feeder, 50 ton/hr..Stephens-Adamson Mfg Co
Feeder drive, 3 hp sc gear motor.....Westinghouse Elec & Mfg Co
Crusher, Knittel, 900 rpm, 50 t/hr to ⅜ in.....Johnson Kuechler Co
Crusher drive, V-belts and pulleys.....Allis-Chalmers Mfg Co
Crusher motor, control, 50 hp, 1450 rpm..Westinghouse Elec & Mfg Co
Coal elevator, Redler, 11-in., 50 t/hr, 80 fpm..Stephens-Adamson Mfg Co
Elevator drive, DeLaval worm gear.....Turbine Equipment Co
Elevator motor, 25 hp, 725 rpm, induction..Westinghouse Elec & Mfg Co
Coal-storage bin, 400 tons cap, steel shell....Stephens-Adamson Mfg Co
Protective coating, storage bin interior.....Wailes Dove Hermiston Corp
Elevator, Redler, 2½-10 t/hr, 7½-30 fpm....Stephens-Adamson Mfg Co
Elevator drive, gear motor, 30-7.5 rpm....Westinghouse Elec & Mfg Co
Conveyor, Redler, 2½-10 t/hr, 6¼-25 fpm...Stephens-Adamson Mfg Co
Conveyor drive, dc gear motor, 30-7.5 rpm..Westinghouse Elec & Mfg Co
Conveyor-drive control, dc field rheostats...Westinghouse Elec & Mfg Co
Coal scales, 3, automatic, 200 lb cap.....Richardson Scale Co
Feeder hoppers, 5 ton, level control & alarm.....Riley Stoker Corp

Draft Equipment:

Forced-draft fans, 2 Turbovane.....B F Sturtevant Co
36,000 cfm at 9.2-in. S P, vane control, single-width, single-inlet.
F D fan drive, 2 single-spd motors per fan..Westinghouse Elec & Mfg Co
1—20 hp, 725 rpm and 1—75 hp, 1450 rpm induction motor per fan.
Induced-draft fan, one for two blrs.....B F Sturtevant Co
75,000 cfm at 9.4 S P, vane control, single-width, double inlet
I D fan drive, 2 single-speed motors.....Westinghouse Elec & Mfg Co
1—75 hp, 480 rpm and 1—200 hp, 720 rpm induction motor
Emergency I D fan, 1, 70,000 cfm at 10-in. S P, 720 rpm..Clarage Fan Co
Emergency I D fan Drive, 200 hp, 725 rpm G E ind motor..F B Cutter Co
Emergency I D fan flexible coupling.....Bartlett Hayward Co
Duct work.....Heilman Boiler Works
Flue-gas scrubber, 4-section.....Riley Stoker Corp

Feedwater System:

Boiler-feed pumps, 3, turbine-driven, Cameron.....Ingersoll Rand Co
2—137 gpm, 1550 ft, 3100 rpm; 1—400 gpm, 1610 ft, 2650 rpm
Pump turbines, 150 lb, 500 F, 20 lb bp.....Terry Turbine, Elliott Co
1—200 hp, 3550 rpm, Elliott; 1—180 hp, 3550 rpm, Terry; 1—425 hp, 2900 rpm, Terry
Flexible couplings.....Bartlett Hayward Co
Excess-pressure governors.....Fisher Governor Co
Feedwater heater, Cochrane.....Turbine Equipment Co
Raw-water, condensate pumps, 5, 350 gpm.....Worthington P & M Co
Pump motors, induction.....Westinghouse Elec & Mfg Co
Feedwater Treatment, Zeo-Karb H.....Permutit Co
Zeo-Karb H, tank, multiport valve, meter, solution tanks, degasifier
Storage tanks.....Edwin C Wolfers, Altoona Pipe & Steel Supply Co
Phosphate feed pump.....Deming Co
Acidproof brick.....Quigley Co
Feedwater stop-and-check valves.....Consolidated Ashcroft Hancock Div

Generating Equipment:

Turbine, 3600 rpm, 550 lb, 700 F, 150 lb bp..De Laval Steam Turbine Co
Reduction gear, 2887 hp, 3600/1500 rpm.....Elliott Co
Generator, 1500 kw, 440 v, 3 ph, 25 cycle..Westinghouse Elec & Mfg Co
(Generator and reduction gear transferred from another plant)
Generator air cooler, 4 pass, 625 sq ft.....Westinghouse Elec & Mfg Co
Turbine gage panel and gages.....Foxboro Co

Desuperheater and Reducing Valves:

Main reducing valve, 3½-in., 75,000 lb/hr.....Republic Flow Meters Co
High-lift balanced type, double-acting hydraulic cylinder, with 4-in. hand-operated globe valve in parallel
Desuperheater, 150,000 lb/hr, Venturi type.....Republic Flow Meters Co
Reducing valves, 3, 150/20 lb, 20/5 lb, 600/130 lb.....Spence Engrg Co

Piping, Valves, and Fixtures:

High-pressure valves.....Chapman Valve Mfg Co, J H Frischkorn, Jr
Small high-pressure valves.....Crane Co
Low- and medium-pressure valves.....Reading, Pratt & Cady Co
Relief valves..Atwood & Morrill, Davis Regulator Co, Kennedy Valve Co
Float valves.....H Belfield Co
Piping.....Midwest Piping & Supply Co, E F Keating Pipe Bending Co
Flexible-steel expansion joints.....Foster Wheeler Co
High-pressure bolts, Class C, 125,000 T S.....Wm Haskell Mfg Co
Piping gaskets.....Goetze Gasket, Durabla Mfg Co
Fittings.....Reading, Crane, Walworth, J H Frischkorn, Jr
Insulation.....Chas S Wood & Co

Meters and Instruments:

Boiler-control panel.....Republic Flow Meters Co
Blr control, 2 multipointer ind, 1 3-pen, 1 4-pen recorder, 2 steam and 2 water integrators, 12 pt temp ind, 2 boiler level ind
Boiler-room clock.....Consolidated Ashcroft Hancock Div
Pressure gages.....Consolidated Ashcroft Hancock Div
Fuel-oil gages.....The Engineer Co
Electric meters.....Westinghouse Elec & Mfg Co
Desuperheater panel and controls.....Republic Flow Meters Co

for CO_2 removal. Treated water collects in a 1-hr storage tank.

Passing excess steam through the water in the open heater partially deaerates it, and the process is completed by addition of sodium sulphite. Heater steam comes from the exhaust of turbine-driven boiler-feed pumps; any additional steam needed is taken from the 20-lb system through a reducing valve. One feed pump is extra large for emergency operation of the plant at 150 lb. Feedwater entering the No. 3 drum forms a screen through which all steam must pass to reduce carryover.

Continuous blowdown holds concentration of total solids to less than 2000 ppm. Blowdown flashes to the 20-lb mill system, and the residual flows through a plate-type heat exchanger, and a rate-control box to the sewer.

Instruments and Control

Instruments and control for the two boilers are centralized on a four-section panel. Boiler control is by the Smoot system. The master regulator balances spring-tension against header pressure, thus controlling air-loading pressure on individual air-flow and fuel-feed regulators. The spare pulverizer has no control; two pulverizers are normally used per boiler, so spare is controlled from other pulverizer (see Fig. 4). After a year's operation two more regulators were installed. One maintains sufficient suction to keep boiler-outlet dampers within good regulating range, and the other holds a definite pressure across the feeder tables by controlling primary air to the pulverizer fans. The mercury-differential feedwater regulator carries slightly higher levels at higher loads.

Installation of a 9-stage, 3600-rpm, 2820-hp backpressure turbine, exhausting at 150 lb, added needed generating capacity. The unit drives a semi-inclosed generator through a 3600/1500-rpm reduction gear; both generator and gear were transferred from another plant. Installation of an air cooler in a pit under the generator increased capacity. A combination constant-speed oil-operated backpressure governor controls the unit, and both spindle-driven and steam-driven oil pumps are provided. Full load water rate of the turbine is 41 lb per kwhr; tests show maximum capacity to be 2100 kw.

When the turbine is not in service or when more 150-lb steam is needed than the turbine supplies, additional low-pressure steam is obtained through a pressure-reducing station. A high-lift balanced valve, directly operated by a double-acting hydraulic cylinder, reduces a maximum of 75,000 lb per hr from 600 to 150 lb. A hand-operated globe valve, of the same capacity, is connected in parallel. The needed lowering of temperature is accomplished by a 150,000 lb per hr Venturi-type desuperheater. A differential-pressure diaphragm regulator controls water supply to the desuperheater, balancing water pressure against steam pressure, and a tempering valve regulates the amount of temperature reduction, giving constant steam temperature at all flows (Fig. 4). Other reducing valves, without desuperheat, supply low-pressure steam for emergency operation of auxiliaries, process, and feedwater heating.

One of the biggest achievements at Williamsburg was the building of the new plant without interrupting continuous production. Four old boilers and all coal and ash-handling equipment had to be razed before one new boiler could go in, so four locomotives were hoisted alongside and fired-up.

Construction

Moving on a carefully worked out schedule, old equipment was torn down and one new unit was erected. After drying out and preliminary operation at 150 lb, pressure was stepped up to 600 lb and more old boilers were ripped out so work could start on the second new boiler. At its completion, the locomotives and the two Heine boilers in another building were shut down. During this time, the new turbine was delivered, assembled and run up to speed in eight days.

Maintaining pressure on three sets of boilers, moving coal and ashes by hand, and coordinating the work of operators and construction men was a tough job, but the schedule was met and no steam or power outage was experienced. While the construction work was progressing and for some time after, classes were held for the operators, to familiarize them with the new equipment.

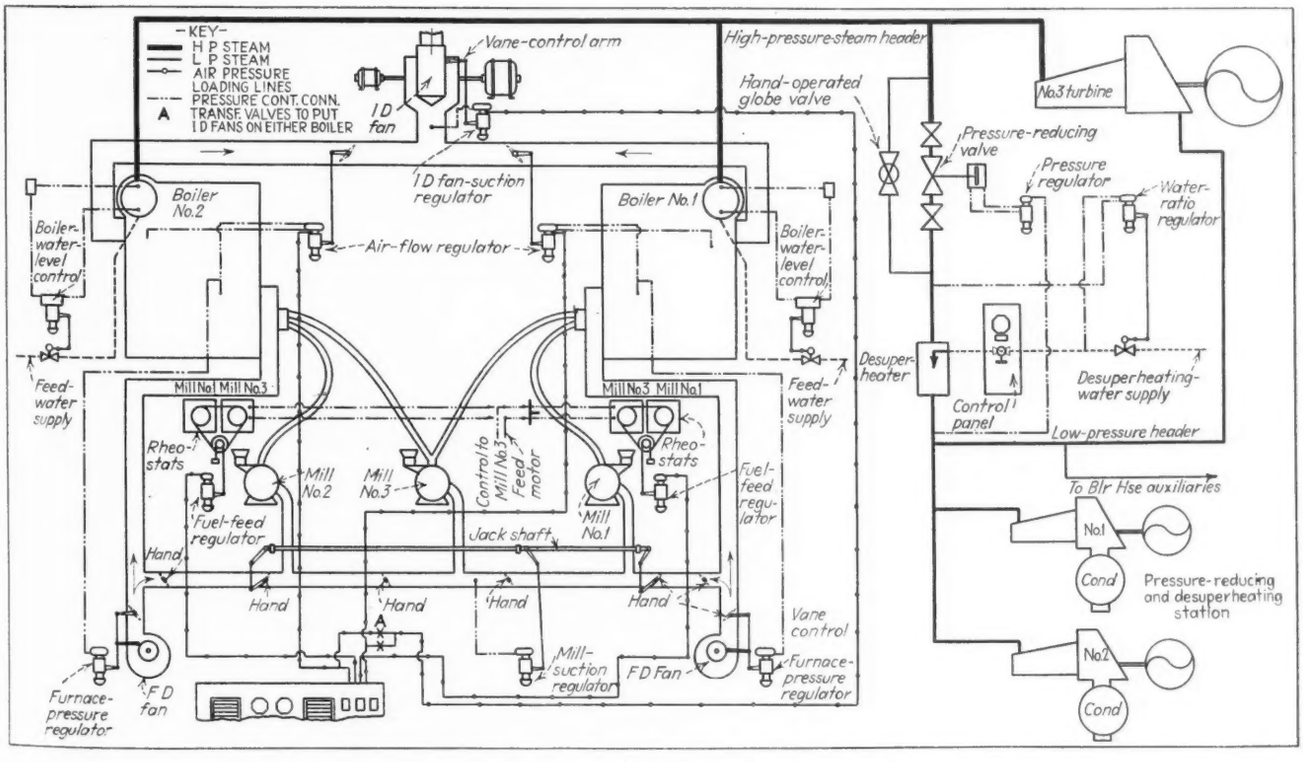


Fig. 4—Automatic control for combustion and pressure-reducing equipment

Hydraulic Couplings Make Difficult Starting Easy

They permit application of standard general-purpose squirrel-cage motors to many heavy-starting loads in power and industrial plants

By G V EDMONSON
Hydraulic Coupling Div, American Blower Corp

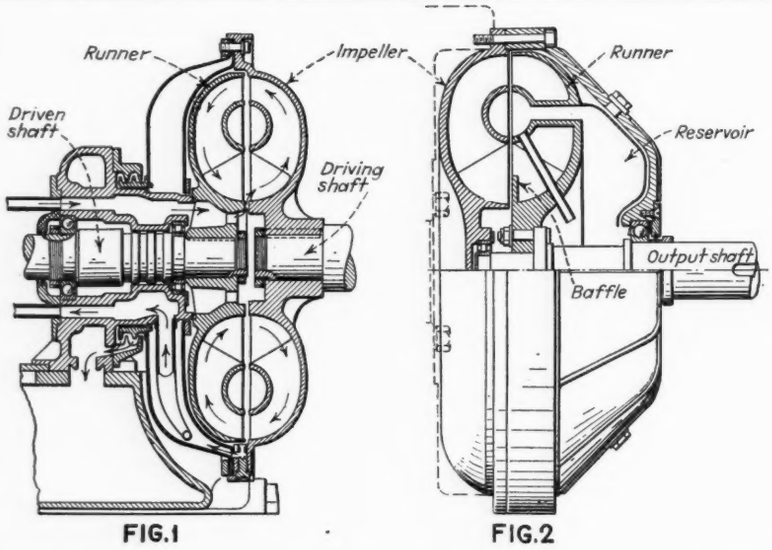


FIG.1

FIG.2

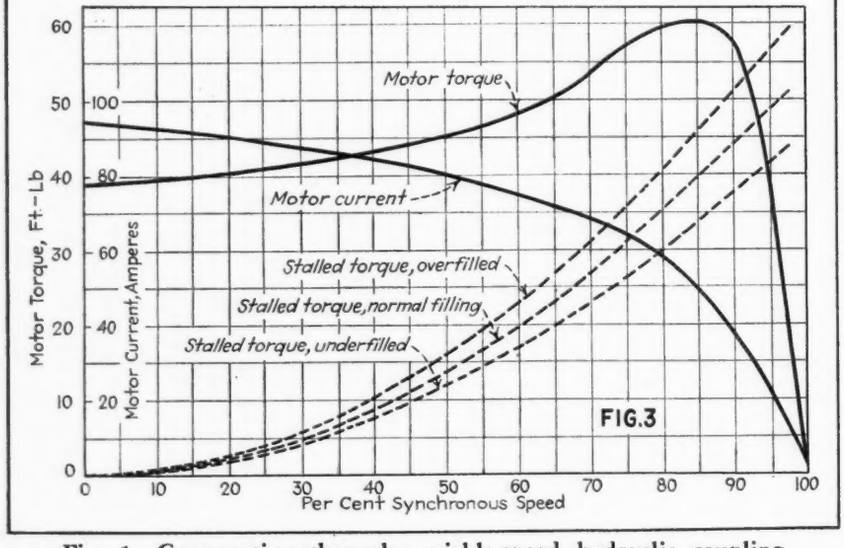


FIG.3

Fig. 1—Cross-section through variable-speed hydraulic coupling.
Fig. 2—Cross-section through a traction-type hydraulic coupling.
Fig. 3—Characteristics of a traction hydraulic coupling and a normal-torque squirrel-cage motor

HYDRAULIC couplings are used in practically every field of engineering, to control speed, to make difficult starting easy, to absorb shocks, etc. They have been applied to excavating, industrial, power-plant, marine and transportation equipment to connect engines and motors to their loads.

A hydraulic coupling comprises a primary element, known as the impeller, and the secondary element or runner, Fig. 1. The coupling is filled or partly filled with a light mineral oil. Power from the input shaft is transmitted to the output shaft by the impeller. The impeller performs as a pump to deliver oil to the runner, which acts like a water wheel. Fluid circulates in the coupling as indicated by the arrows.

Hydraulic couplings are built in three principal types: variable speed, Fig. 1, traction, Fig. 2, and marine. The principle of power transmission is the same in all three. The traction coupling with which this article deals, is for starting and for use as a flexible coupling between the power unit (engine or motor) and its load. The traction coupling has the oil reservoir mounted on the back of the runner, Fig. 2, but the variable-speed coupling has its oil reservoir separate from the coupling and amount of oil in the coupling is controlled to adjust output speed.

Traction Coupling

The reservoir on traction couplings is connected to the working circuit by tubes which permit oil transfer from one to the other. At standstill and at low speed a large part of the oil is in the reservoir, thus permitting starting at low loads. When the drive unit reaches a predetermined speed, oil automatically returns to the working circuit to accelerate the load. At full speed of the driving unit, the load will accelerate to a speed within about 2% of input speed. The reservoir acts also as an expansion chamber to prevent high pressures building up in the coupling. The baffle, a metal ring attached to the inner profile of the runner circuit, reduces drag torque at starting and limits stalling torque. At

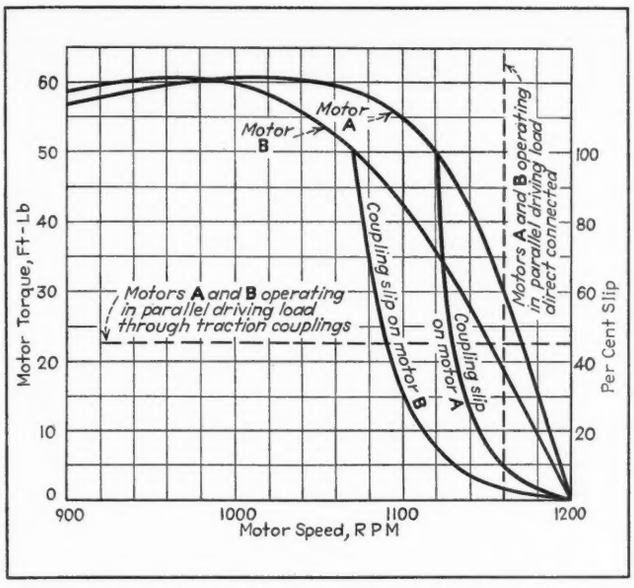

Motor Torque, Ft-Lb
Per Cent Slip
Motor Speed, R P M
Motor A
Motor B
Motors A and B operating in parallel driving load through traction couplings
Coupling slip on motor B
Coupling slip on motor A
Motors A and B operating in parallel driving load direct connected

Fig. 4—Load division between two squirrel-cage motors directly connected to the same load and connected through hydraulic couplings

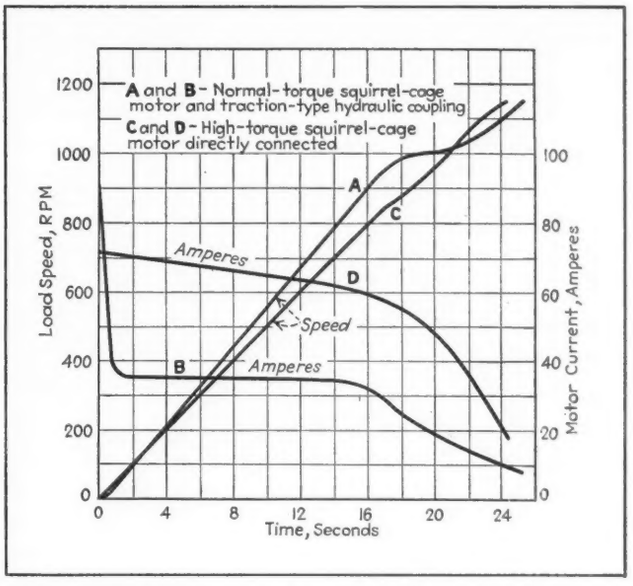

A and B - Normal-torque squirrel-cage motor and traction-type hydraulic coupling
C and D - High-torque squirrel-cage motor directly connected
Load Speed, R P M
Motor Current, Amperes
Time, Seconds
Amperes
Speed
Amperes

Fig. 5—Performance curves of a high-torque direct-connected squirrel-cage motor, and a normal-torque motor with hydraulic coupling, starting high-inertia load

full-load speeds, centrifugal force of the oil in the working circuit is high and tends to force it away from the coupling axis. Oil circulation in the vortex ring is low, however, since the relative velocities between impeller and runner are low. Consequently, force tending to cause oil to flow along the outer wall of the working circuit is small. The resultant of the two forces is such that the vortex ring of oil clears the baffle and therefore does not affect the coupling performance. At reduced speeds and high relative velocities of impeller and runner, radial centrifugal force is lower and velocity of circulation in the vortex ring is high. Then, the force tending to cause oil to follow the outer wall of the working circuit is high. A reduction of the effective quantity of oil by the baffle results.

A traction coupling between a motor and its load allows the motor, regardless of the load characteristic, to start unloaded and to accelerate as if driving a centrifugal pump. Fig. 3 is a characteristic curve of a normal-torque squirrel-cage motor and a traction coupling of a size which will transmit efficiently rated motor horsepower. Torque that this coupling will transmit at any motor speed depends on the quantity of oil in the coupling. The stalled-torque curves represent maximum limits of the coupling for transmitting torque when filled with a certain quantity of oil. When the motor reaches a speed where the coupling is capable of transmitting maximum motor torque with the coupling output shaft stalled, a point is attained beyond which the motor will not accelerate.

When the coupling torque is sufficient to start the load, coupling output-shaft speed will increase as rapidly as torque developed by the motor, and will overcome inertia and static load of the driven machine. If torque required by the load at top speed requires full-load torque of the motor, then the motor will run at its full-load speed.

If load driven by a motor through a traction coupling increased to where a direct-connected motor would stall, the coupling runner will stall at a predetermined point. The motor will then continue to run, the torque developed by it depending on the coupling design, but taking much less than stalled-rotor current.

Stalling Characteristic

The hydraulic coupling will stall and protect conveyors in case their load jams. Then, when the cause of the trouble is removed, the conveyor is immediately ready to go back into service. The coupling also permits the motor to start with no load and to take load as it speeds up, with a reduced starting current.

Stalling characteristic of traction couplings allows exerting a controlled maximum pull from a winch mechanism driven by a squirrel-cage motor without complicated motor control. An interesting application of eight squirrel-cage motors and traction couplings has been made in England on lock-gate machinery. The couplings permitted developing a maximum pull on the gate chains which would close the gates and maintaining this pull until the brakes could be set, without harming the motor or lock mechanism.

Division of load between two or more squirrel-cage motors operating in parallel is a difficult and rather expensive problem. With a hydraulic coupling between each squirrel-cage motor and its load, torque developed by each can be readily balanced. Fig. 4 shows speed-torque characteristic curves of two motors that vary slightly in speed when developing full-load torque. With the motors directly connected in parallel and running at a load speed of 1160 rpm, one motor will develop a torque of 18.25 ft-lb and the other will develop a torque of 29.5 ft-lb, a difference of 11.25 ft-lb. With a traction coupling between each motor and its load, one motor will develop 22.5 ft-lb torque at 1170 rpm and the other 22.5 ft-lb at 1151 rpm. The coupling on motor *A* slips 6% so that its output-shaft speed is 1170 x (1.00—.06) = 1108 rpm and runner-shaft speed of coupling *B* is 1151 × (1.00—.038) = 1108 rpm, because this coupling slips only 3.8%. Torques developed by the motors and coupling-output shaft speeds are the same.

This characteristic of the traction coupling provides a solution to drive problems on monorail conveyors where as high as 6 or 7 power units may be driving the same chain. To balance the load on such a system, placing of the drive units along the length of the chain is planned so as to compensate for variation of chain load resulting from elevating, lowering, and unloading portions of the chain for production processes. Even with the most careful consideration, trouble with load balance often occurs. Locations where production processes are carried out are often changed after the conveyor has been installed, thus altering the load conditions.

Traction couplings permit starting high-inertia loads with normal-torque

squirrel-cage motors with comparatively low input current to the motor. Fig. 5 gives comparative performance of two motors with similar horsepower ratings and the same synchronous speeds. Curves *A* show acceleration of a normal-torque squirrel-cage motor driving a high-inertia load, through a traction coupling, and curve *B* indicates current required when starting the load. Curves *C* and *D* show acceleration and current respectively of a direct-connected high-torque, low-current, squirrel-cage motor when starting the same load. If starting and stopping are frequent, a considerable saving in power may result from using the traction coupling.

The peak current, curve *B*, in the first 0.8 sec, represents the current required to accelerate the motor rotor and is independent of the nature or magnitude of the load driven by the traction-coupling output shaft. The current surge is an inherent characteristic of the motor and causes the motor rotor to accelerate very rapidly. This comparison has been made with full-voltage start.

Auto-Starters

Local power conditions determine whether it is possible to start a loaded motor at full-voltage or whether an auto-starter must be used. No attempt has been made to show performance of a direct-connected motor with an auto-starter to limit starting current to the same value as that obtained when starting through the traction coupling. Torque developed by an induction motor varies very closely as the square of the voltage. Therefore, had an auto-starter been used, a much larger motor would have been required to accelerate the load at the same rate as when the squirrel-cage motor and traction coupling were used.

Among heavy-starting loads, the centrifugal separator found in chemical, laundry, sugar, dairy and many other industries may be mentioned. Many heavy starting loads are found in the steel industry where heavy machinery and weights must be accelerated. Opening and closing of draw bridges, and the operation of turn tables is accomplished more smoothly through traction couplings than by direct-connected motors. Squirrel-cage motors may be reversed while running at full-load speed in one direction without the high-current values experienced with direct-connected motors.

It will be found that the traction coupling makes possible application of normal-torque squirrel-cage motors to a great variety of machinery. Motor sizes in many cases may be reduced and inherent characteristics of traction couplings will encourage better machinery design.

Old Boilers Learn New Tricks

Last month we talked about "making the best of the old plant". Here's an actual case where savings were made by pinning down the source of greatest loss and spending only enough to prevent it

By STUART W ALLEN
Consulting Engineer, Providence, R. I.

THE MECHANICAL superintendent of a leading New England textile plant recently found that extensive repairs to the settings of two 5000-sq ft Stirling boilers were necessary. For some time, thought had been given to new equipment, but for various reasons nothing had been done. So, when repairs to two boilers were needed, it was decided to do the job in such a way that the boilers could fit into any future scheme of development. But, regardless of what the future plans might turn out to be, or even if they didn't go through, it was desirable to increase the efficiency of the boilers and hold setting maintenance at a minimum.

In this plant, steam, and some electricity, are generated in a building, approximately square, alongside one of the manufacturing departments. Probably half of this space could be added profitably to the manufacturing area. About 25% of the power plant building is now occupied by an engine room, adjacent to the factory. Six Stirling boilers, of more or less uncertain age, set in batteries and oil fired, extend along one side of the building, as shown in the sketch, Fig. 2. The boilers under discussion here are located on the other side of the building and were installed at a later date.

The strategic position of these two boilers can be seen readily from the layout. Expansion of manufacturing facilities would affect the near end of the building, adjacent to the factory; expansion of power plant would involve a building extension or a new building near the outer end of the existing structure. In either case, the boilers to be modernized would be close to the new equipment and would fit in with it. Thus, even with a comprehensive expansion of power facilities in view, the modernization of these boilers could be justified.

Now for the boilers themselves—originally installed to burn anthracite, coke, or any low-volatile solid fuel and equipped with forced-draft chain-grate stokers. They were rebuilt for oil several years ago when it became apparent it was no longer economical to utilize the original installation. Flat-flame oil burners were used, similar to those installed in the other boilers. While this installation gave reasonably good results and easily paid for itself, it eventually became obvious that a more modern layout might make real savings in steam cost. Poor air distribution and flame impingement had punished refractory so that a large portion had to be rebuilt and the bridge walls needed complete replacement.

New Burners

As these two boilers were set in battery and were always operated together, it was decided to make a single boiler with single furnace permitting better spacing of burners. With the loads it was desired to carry, the conventional flat-flame burner was out of the question, due to inability to obtain

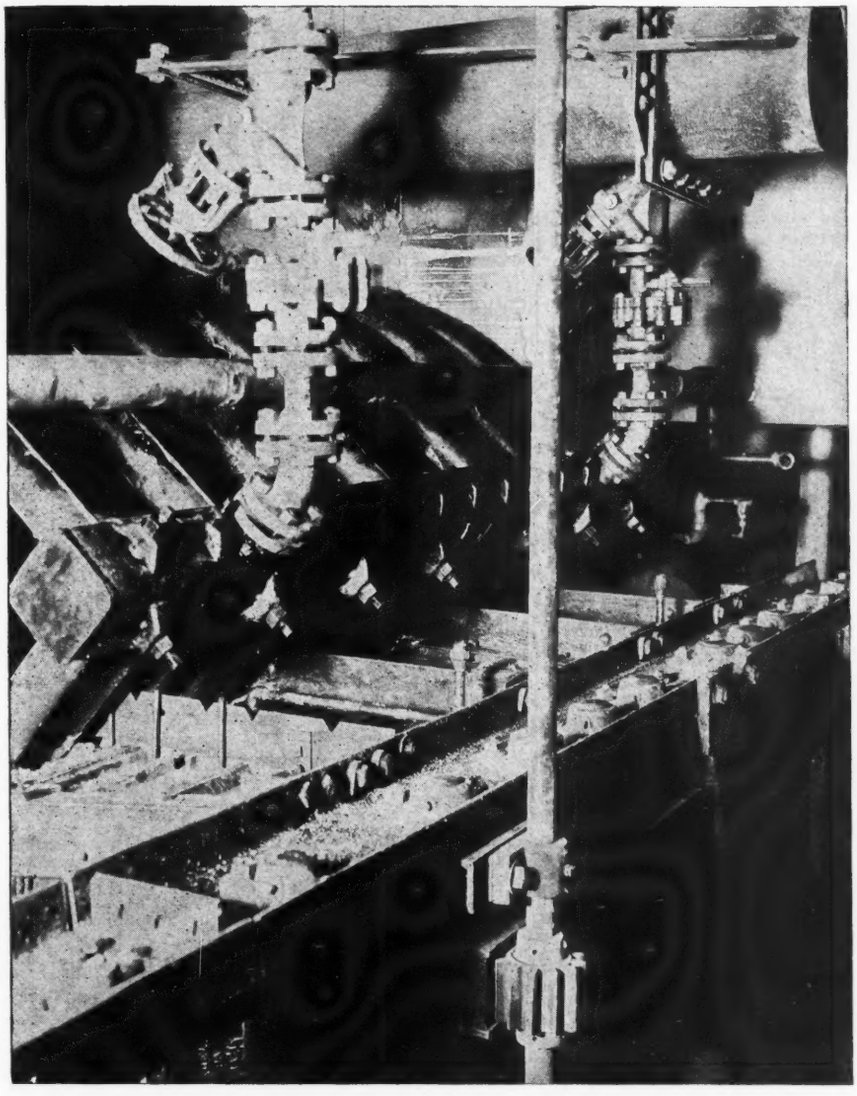


Fig. 1—Header at bottom of boiler bridgewall modernized in the manner described here

proper air distribution. Forced-draft register burners, however, would take care of this difficulty and produce a flame within the 9 ft available to the bridge wall. The burners installed provide rapid mixing of fuel and air and a short, intensely radiant flame that can be maintained at a proper distance from the refractory.

Forming Single Unit

To form a single unit, the party wall was completely removed and a sectionally supported wall built between the tubes. This allowed the old baffling to be retained and permitted gas travel in both boilers to be the same as before the changes. Air, admitted at the base and escaping at the top, cools the sectionally supported wall. No effort is made to recover heat in this air as it was found that the cost of doing so would offset the savings to be effected. Four tubes directly in front of the division wall prevent radiant heat from entering the section between the boilers, and thus protect the front facing. The tubes extend from a short header at the floor line to another short header at the top; headers are connected to the mud drums and the upper front drums.

To obtain the highest economically justified recovery of radiant heat, a water-cooled bridge wall and a slag screen were installed. Forged-steel headers at the floor line connect to the mud drum by downcomer tubes spaced approximately evenly along the rear of the headers. One header was required for each boiler. Tubes entering the face of the headers lead upward with alternate tubes entering the mud drum near the center line. The remaining tubes pass upward and in front of the boiler tubes to enter the front drums. These long tubes are spaced some distance in front of the boiler tubes constituting a slag screen. They absorb radiant heat without blanketing the front bank of boiler tubes.

Slag screen and bridge-wall tubes are bare for most of their length, being covered from the point where they bend to enter the lower headers. In this way full advantage is taken of the radiant heat from the turbulent-type burners. The added tube surface introduced by these changes increases the black surface considerably, and by so doing reduces the amount of radiant heat reflected to the brickwork, materially increasing refractory life.

Water tubes of the bridge wall are backed up by plastic refractory, which was rammed in place between the tubes and corrugated metal backing. During construction, corrugated paper was placed around the tubes to prevent adhesion of the plastic and to allow full movement of the tubes without danger of cracking the plastic backing.

Done by Plant Labor

Recutting and bending available boiler tubes cut the cost of the change considerably, and the job was completely erected by plant labor. Retaining the existing baffling, which was in good condition, also helped keep the first cost low. Another reason for holding off on the installation of new baffles was the desire to check the effect of water-cooling on flue-gas temperatures and general boiler efficiency, so that full advantage could be taken of this information in future development and maintenance work. However, the design was such that cross-baffling could be installed if and when desired.

This installation, which has given practically a year's continuous service, has borne out the expectations of its designers in lowered net steam costs, after full allowance for fixed charges. Careful measurement of fuel consumption and quantity and quality of steam delivered prove these savings. Observations show that flue-gas temperatures are lower and that volume of flue gas is less. In this case, the most for every dollar invested was obtained by the exercise of ingenuity and maximum use of existing facilities.

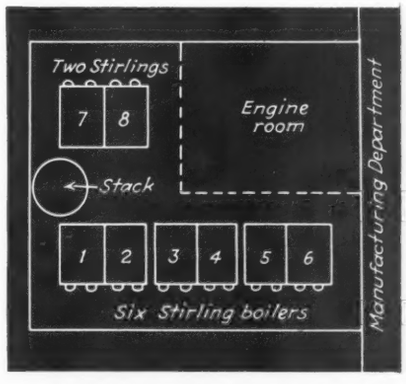


Fig. 2—Power-plant layout

Waterside Tops Again

New York's historic Waterside Station puts in service its second topping turbine. The first one, a 53,000-kw unit, has been operating eight months

By H KNECHT
Division Engineer, Consolidated Edison Co of N. Y.

WATERSIDE'S first topping turbine differed from other 1937 installations in that an entirely separate turbine section direct-connected to the main turbine shaft supplies steam for feedwater heating. This feature is retained in the second installation now ready for preliminary operation.

Continuing an extensive modernization program, the second 53,000-kw turbine with its associated two 500,000-lb-per-hr steam generators has no 1200-lb, 900-F steam interconnection with the first similar unit. Ultimate plans call for four such 53,000-kw unit plants all to be housed in one of the two city-block size building structures. The complete program involves the retirement of eight vertical turbine-generators and 92 low-pressure boilers, all the equipment of the one building. A large part of the retirement and removal of this history-making equipment of three decades ago has already been effected.

Although physically separated by a city street, the high-pressure and low-pressure plants operate as a single station, effectively tied together by steam, water and electrical lines. The 2,000,000 lb per hr of 200-lb steam now exhausted from the two high-pressure turbines supplies part of the requirements of two remaining horizontal turbines in the high-pressure plant and seven others across the street. In all, these low-pressure turbines have a capacity of 271,000 kw, the entire station 377,000 kw.

The heat balance, suited to the limitations of the plants' physical separation, follows out a broadly conceived initial plan. Condensate from the low-pressure station is initially heated to about 150 F in five paralleled closed heaters by auxiliary exhaust steam before return to the high-pressure station. Deaeration in the high-pressure plant is assured by the adequate supply of 5-lb g steam available under all operating conditions from the exhaust of the feed-heating turbine.

A section of the 53,000-kw General Electric turbine, shown in Fig. 1, illustrates the common-shaft arrangement of the two turbine sections, the main unit of 12 stages and the feed-heating unit of 8 stages. The main section takes steam at 1200 lb, 900 F, exhausts at 200-lb, 508 F, and contributes 50,000 kw at full load. Main-turbine exhaust at 200 lb supplies the feed-heating section, which exhausts at 5 lb g, contributing 3000 kw.

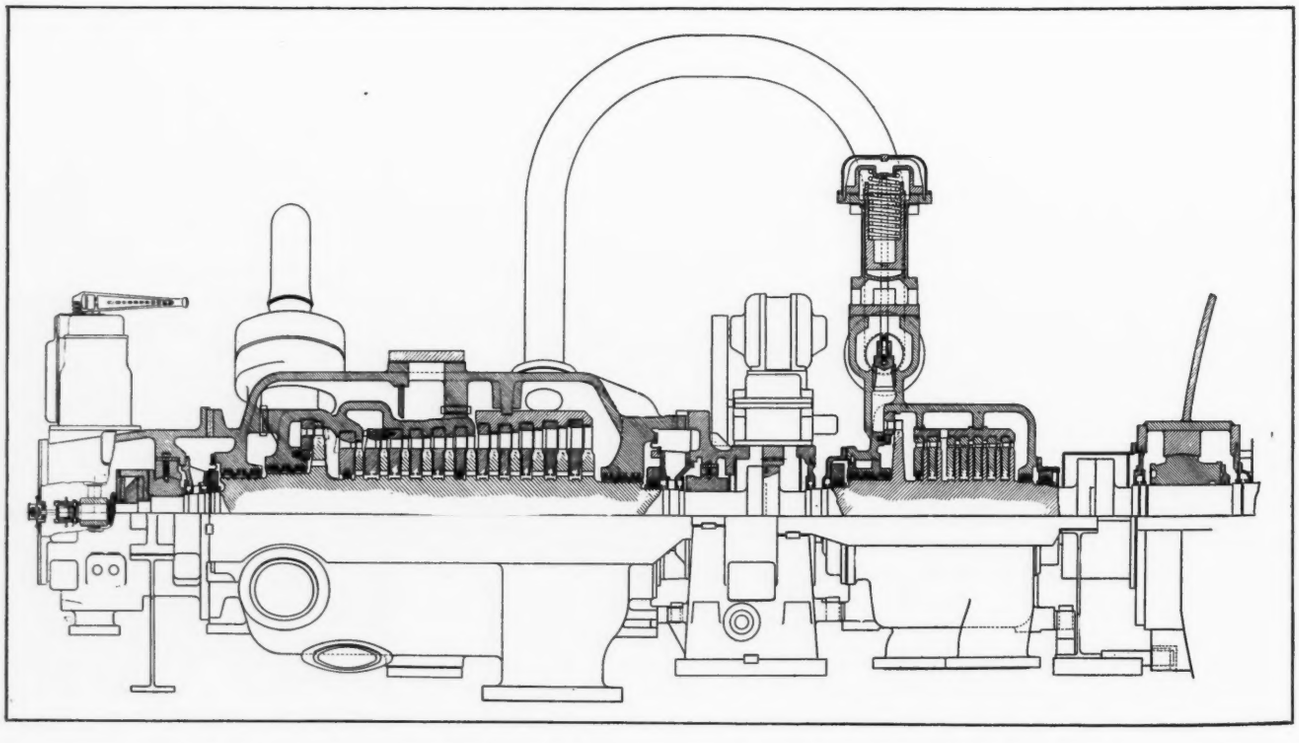


Fig. 1—Section of 53,000-kw high-pressure turbine unit showing 3000-kw feed-heating turbine on common shaft

The double-casing design has now become familiar construction. The inner high-pressure shell is surrounded by steam at about 450-lb pressure. Shaft-packing gland seals are combined labyrinth and water-seal type. Cut-tooth diaphragm packing rings and labyrinth shaft teeth minimize leakage along the shaft. Motor-driven turning gear rotates the spindle at approximately 3 rpm. This gear also serves as a jacking device for turning the rotor over during inspection.

The governing system's three parts are interconnected to give coordinate operation. The customary speed-load-control shaft governor operates six control valves by a hydraulic cylinder. Movement is transmitted by rack and pinion to the control-valve cam shaft, resulting in sequential opening of the control valves on increase of load. The feed-heating turbine has a similar speed-load control operating five bar-lift control valves.

The overspeed control consists of a shaft-operated emergency governor, two emergency-trip valves and four air-operated stop valves. Main steam supply passes through two of the latter valves, feed-heating turbine supply through the other two. On overspeed, air pressure, holding the four stop valves open, is released and the valves are spring-closed. Use of air instead of oil for stop-valve operation eliminates an oil-fire hazard. Air is normally taken from the station compressed-air system but a separate compressor starts automatically on loss of supply pressure.

Control Devices

Backpressure is regulated to an upper limit of 210 lb. A rise in pressure causes the regulator to start closing the hydraulic-operated control valves. On the feed-heating turbine, an exhaust regulator maintains a backpressure of 5 lb g by controlling steam admission to the feed-heating unit.

To prevent damage to the turbine caused by factors other than overspeeding, several additional devices have been employed. In the case of the 200-lb backpressure regulator, a continued rise of backpressure might eventually close off all steam to the unit, perhaps resulting in blading damage due to insufficient cooling steam. The mechanism is arranged so that at no time can it close the control valves beyond a safe minimum opening.

Motoring of the unit due to accidental tripping of the stop valves is prevented by a light and alarm that warn the operator if the stop valves close for any reason. Also, a directional relay actuates an alarm on the main switchboard in event of reversal of power flow into the generator.

Vertical twin pumps installed in the main oil reservoir, 30 ft beneath the generator end of the machine, supply oil for lubrication and the control system. The oil reservoir is remote from all steam piping, although the oil pumps are gear-driven from the generator shaft. Each pump is in two sections, one supplying high-pressure oil to the control system and the other low-pressure oil for lubrication. A steam-driven auxiliary pump is used in emergency and for starting; it is automatically cut in by a drop in pressure in the governor oil system.

A separate motor-driven pump supplies bearing lubrication when the turning gear is in operation. This pump also cuts in in case of failure of the steam-driven pump. The turning gear is electrically interlocked against starting unless the pump is in operation.

Hydrogen-Cooled Generator

In line with present day practice on machines of this size and speed, the generator is hydrogen cooled having fans on either end of the rotor. Four fin-type hydrogen coolers, two on each side of the stator, are inside the gas-tight, explosion-proof casing. Tubes parallel the axis of the generator. Valves permit isolating any one of the coolers without taking the machine out of service.

Distilled water is circulated through the hydrogen coolers. It flows in a

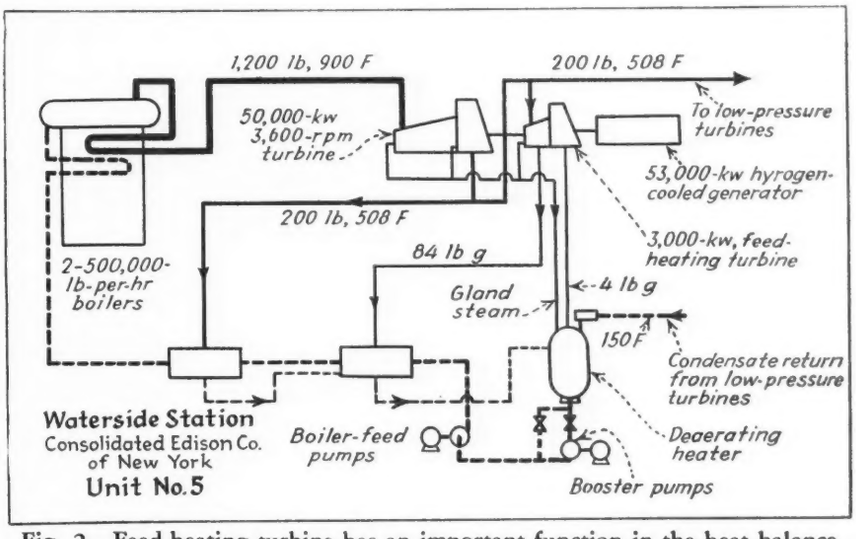


Fig. 2—Feed-heating turbine has an important function in the heat balance

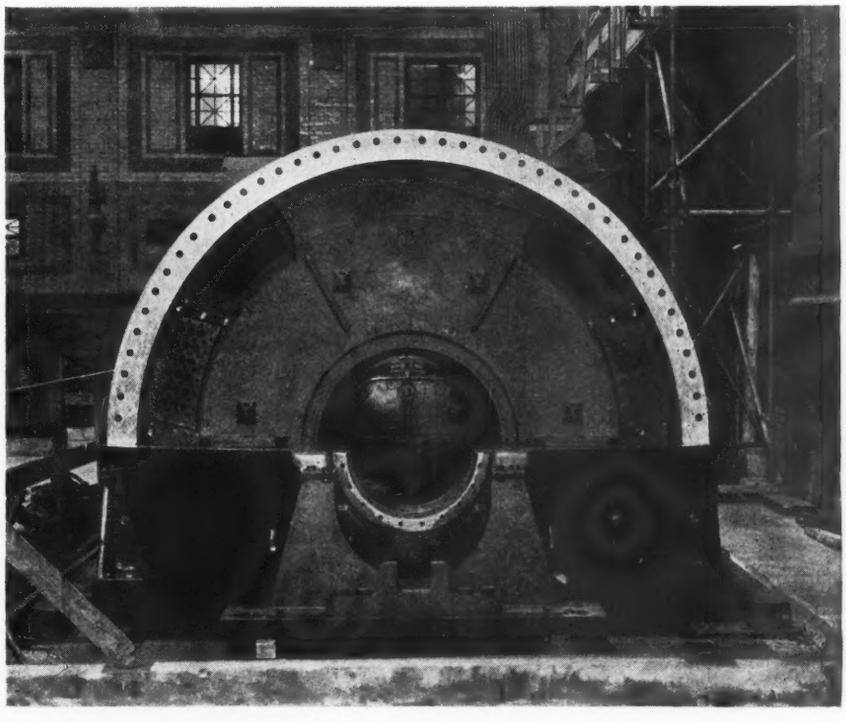


Fig. 3—Generator stator showing hydrogen-cooler arrangement

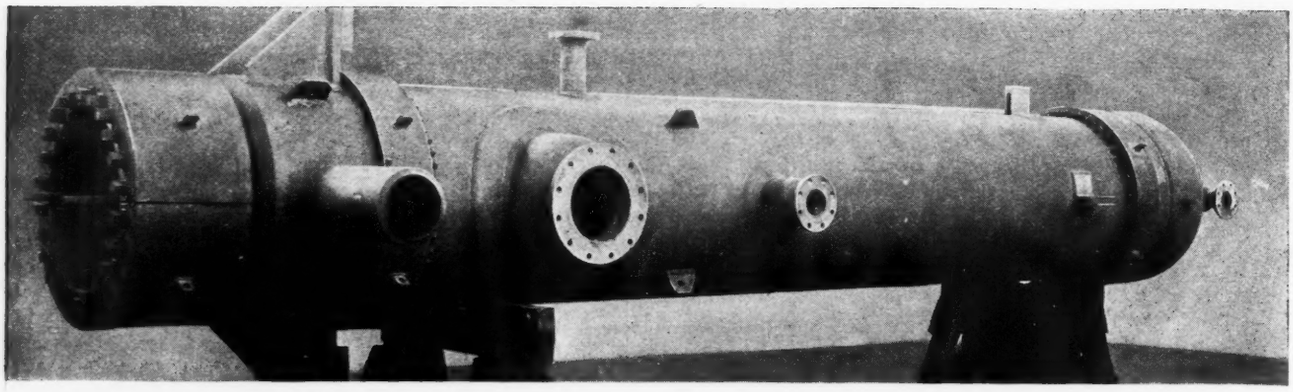


Fig. 4—Shop view of high-pressure feedwater heater. Vertical installation conserves needed boiler-room space

closed circuit through a separate pump and external heat exchanger, the latter supplied with salt water from the house-service system. An emergency city-water connection cuts in automatically through a motor-operated valve to supply the distilled-water system in event of generator-temperature rise.

An elaborate system of controls and alarms maintains safe operating conditions in the hydrogen-filled casing. On a panel close to the generator are a hydrogen purity indicator, a gas pressure gage, hydrogen temperature indicator and a number of lights and alarms to indicate unsafe conditions. There is also a water-detecting device to indicate presence of water or oil in the generator casing.

Oil seals prevent hydrogen leakage from the generator casing. Lubricating oil supplied to generator bearings flows part to the seal and part to the bearing-lubrication groove. The oil is treated to remove air picked up in the bearings and hydrogen absorbed in the seals.

In addition to pressure gages and thermometers, supervisory instruments are mounted on a suitable panel. One meter indicates and records turbine-shaft eccentricities. A recording and indicating vibration meter shows smoothness of operation. Speed is indicated and recorded by tachometer.

Basement space is extremely limited. The steel turbine foundation is narrow and high with unusually heavy bracing and loading to reduce deflection and obtain maximum rigidity. The turbine is anchored at the bearing between the main and feed-heating turbine sections and expansion movement, directed toward the outboard bearing, is taken up by a 30-in. flexible I-beam support.

Steam for the turbine is supplied by two 500,000-lb-per-hr boilers, duplicates of those installed for the first topping turbine. Details of this installation were published previously, *Power*, Mid-September, 1937.

Principal Equipment—Waterside Station, Unit No. 5

CONSOLIDATED EDISON CO OF N. Y., INC

Steam-Generating Equipment:

Boilers, 2, sectional header.....Combustion Engineering Co
500,000 lb per hr, 1350 lb, 900 F, 41 tubes wide, 7 high 7003 sq ft, tubes 3½ in. od
Superheater, Elesco.....Superheater Co
Upper bank, 100 elements, 6 loop, carbon steel, 2 in. od
Lower bank, 100 elements, 6 loop, 5 pipes carbon steel, 5 pipes carbon-moly steel, and 2 pipes carbon steel with molybdenum, chromium and titanium, 2 in. od
Furnaces, 20,300 cu ft.....Combustion Engineering Co
15,011 sq ft total water walls and boiler fin tubes
Economizer, Elesco, 18,850 sq ft, return bend.....Superheater Co
680 fin tubes, 24 ft long, 2 in. od
Soot blowers.....Diamond Power Specialty Corp
Steam washer inside drum.....Combustion Engineering Co
Safety valves.....{Consolidated Ashcroft, Hancock Div / Crosby Steam Gage & Valve Co}
4 drum, 2 superheater per blr
Feedwater regulators.....Republic Flow Meters Co
Combustion control.....General Regulator Co
Combustion-control oil pumps.....Tuthill Pump Co
Blowdown valves.....Edwards Valve & Mfg Co
Boiler non-return valves.....Edwards Valve & Mfg Co
Boiler ducts and breechings.....M H Treadwell Co
Structural-steel contractor.....M H Treadwell Co

Pulverized-Coal Equipment:

Pulverizers, 2 per boiler.....Combustion Engineering Co
22,800 lb per hr each, bowl type
Pulverizer drive, 150-hp, 1200-rpm, ac motors.....Elliott Co
Mill exhausters, integral.....Combustion Engineering Co
Coal feeders, 2 per boiler.....Combustion Engineering Co
Drive, 1.5 hp, speed-trol.....Sterling Electric Motors
Coal burners, 8/boiler, 5600 lb/hr.....Combustion Engineering Co
Ignition torch, gas.....Combustion Engineering Co

Coal-Handling Equipment:

Coal bunker conveyor, Redler.....Stephens-Adamson Mfg Co
Magnetic separator.....Cutler-Hammer Inc
Coal scales.....Richardson Scale Co
Coal gates.....Allen-Sherman-Hoff Co

Ash-Handling Equipment:

Slag conveyors.....Combustion Engineering Co
Flyash-handling equipment, pneumatic.....United Conveyor Corp

Draft Equipment

Induced-draft fans, 2 per boiler.....B F Sturtevant Co
139,000 cfm each at 231 F, 12.5 in. wg, vane control
Forced-draft fans, 2 per boiler.....B F Sturtevant Co
87,000 cfm each at 80 F, 9.75 in. wg, vane control
Drive, 600-hp, 690-rpm, sc motor.....Elliott Co
Arranged as duplex units, one fd and one id fan on same shaft driven by a single motor; two duplex units per boiler
Flexible couplings.....Bartlett-Hayward Co
Air preheaters, 2 per boiler.....Air Preheater Corp
Ljungstrom type, 32,700 sq ft each
Precipitators, Cottrell.....Research Corp

Boiler-Feed System:

Feedwater heaters, h-p, clamp-ring type.....Alco Products Inc
1840 sq ft, 2-pass, 500,000 lb per hr, outlet temp 315 F
Feedwater heaters, i-p, clamp-ring type.....Alco Products Inc
2346 sq ft, 2-pass, 500,000 lb per hr, outlet temp 387 F
Deaerating heater, vent condenser.....Worthington Pump & Mach Corp
1,200,000 lb per hr, 525,000 lb maximum storage
Boiler-feed pumps, 3, barrel type.....Foster Wheeler Corp
600,000 lb per hr each, 1450 lb tdh, 6 in., 6 stage
Motors, 2, 1500 hp, 3550 rpm, 2300 v, sc.....Allis-Chalmers Mfg Co
Turbine, 1800 hp, 3 stage.....General Electric Co
Boiler-feed booster pumps, 2, 5 in., 4 stage.....Allis-Chalmers Mfg Co
600,000 lb per hr each
Turbine drives, 260 hp.....Westinghouse Elec & Mfg Co
Feedwater-heater drainage regulator.....Atwood & Morrill
Condensate booster pumps.....Goulds Pumps Inc
Motor drives, 2 sc, 30 hp, 220 v.....Westinghouse Elec & Mfg Co

Metering Equipment:

Boiler meters.....Bailey Meter Co
Feedwater flowmeters.....Builders Iron Foundry
Draft gages.....Bailey Meter Co
Combustion-control instruments and panel.....General Regulator Co
Control board.....M H Treadwell Co

Piping:

Erection contractor.....M H Treadwell Co
Fabrication contractor.....M W Kellogg Co
Valves.....{Chapman Valve & Mfg Co / Crane Co}
Insulation.....{Refractory & Insulation Corp / Johns-Manville / Philip Carey Co}
High and low pressure traps.....Atwood & Morrill
Electric valve operators, Limitorque.....Philadelphia Gear Works

Generating Equipment:

Turbine-generator.....General Electric Co
53,000 kw, 3600 rpm, 1200 lb, 900 F
Automatic extraction at 5, 75, 200 lb g
Oil-cooler water pumps.....DeLaval Steam Turbine Co
Distilled-water pump.....DeLaval Steam Turbine Co
Distilled-water cooler.....Alco Products Inc

Fuel of The Future

One of America's best-known combustion pioneers talks about gas fuel—past, present, future. The ultimate fuel, says Hays, will be coal—in the form of gas piped to houses and power plants

By JOS W HAYS

GAS has long been the most convenient fuel. Some day it will become the most important, as well.

First let's glance at gas history. Wm Murdock, an English engineer, was the first to employ gas for illuminating purposes—the date, 1792. Newport, R. I. (in 1806) saw the first American use of gas illumination. Curiously enough, the installation was for domestic use. In this connection it is interesting to note that efforts are being made right now to market a "gas-making machine" in the rural districts. They show the farmer that he can have gas for cooking and lighting purposes, just like the city people, that he can make this gas out of corn cobs and other waste materials, also that the residual charcoal will season the feed of his hogs and chickens.

Baltimore's city gas plant of 1817 marks the beginning of the "gas era" in this country. Until the advent of electric lighting, illuminating gas had no serious rival other than kerosene oil.

The 19th century's most notable achievement in the field of gas illumination was the "Welsbach mantle." That *was* an invention. In 1880 Dr Welsbach, of Vienna, found that his thorium- and cerium-treated mantles actually jumped "candle-power" from a given flow of gas about 2000%.

The Welsbach mantle gave the gas industry a breathing spell in the illuminating field, solely because it cut the cost of gas per candle-power of illumination. When you increase efficiency you increase use because you decrease the cost of the product. Real profit depends upon volume of business and volume depends, among other things, upon the financial cost to the consumer.

The entire gas industry is fighting today to increase the volume of its business. It cannot hope to recover the ground it has lost in the lighting field. The Welsbach mantle routed the kerosene lamp which had routed the tallow candle and the fish-tail gas burner. The mantle, in turn, was routed by the tungsten filament. Gas has been forced to surrender its lighting load to electricity. You can't stop progress.

The loss of the lighting load left very little for gas except the cooking load and, in a small way, the heating load. Electricity is now making inroads in the kitchen. In the swankier apartment houses in the big cities you cook with electricity or get your dinner at an automat or a night-club restaurant. Years ago electricity captured the hair-curler load, the morning-toast load and other consumer oddments that gas had enjoyed. It was a dark period for gas men, so dark that they hailed the advent of the gas refrigerator with shouts of joy. Gas was glad for even that small come-back.

Natural Gas

I am not speaking, of course, of natural gas, the finest of all fuels. Three quarters of the present output of that fuel is produced in the Southwest and two thirds of it is consumed where it is produced, and in neighboring territory readily reached by pipelines.

The "exportable surplus" is being piped out of its home states and delivered far away at reasonable prices. The first big pipeline out of the Texas Panhandle field carried gas to Denver. Pipes can now carry the Panhandle product as far east as Washington and

Philadelphia, supplying intermediate points. A few years ago natural gas was selling in Tulsa, Okla. for 4.7 cents a therm (100,000 Btu) and in Springfield, Ill. for 5 cents. In many of the large cities, natural gas is now being mixed with locally produced coke-oven gas, in some cases with refinery-residue gas, and sometimes with coal gas and water gas.

At this writing, complete figures are not available for 1937, but the following for 1936 have been published by the American Gas Assn:

Population served by gas companies, 80,000,000. Customers, 16,501,000. Customer increase over 1936, 387,800. Customers served by manufactured-gas industry, 10,177,000. By natural-gas industry, 6,324,000.

Sales of gas for domestic purposes increased 5.4% over 1935, and for industrial and commercial purposes 22.4%. Total sales increased 15.5%. Revenues gained 6.4%.

In the manufactured-gas industry, customers were up 1.8%, sales 6% and revenues 1.4%. Natural gas showed better gains with customers up 3.4%, sales 18.8% and revenue, 11.6%. The consumption of natural gas in 1936 reached an all-time peak of more than two trillion cubic feet. The manufactured-gas industry reports an increase of 30.1%, 1936 over 1935, of customers using manufactured gas in central house-heating plants.

We find, therefore, that gas is not as moribund as one might expect under the circumstances. The gas people are going after the heating load and getting it. There is no competition to speak of between electricity and gas. Gas is a competitor of oil and coal. Whenever gas gets a new customer, either oil or coal loses an old customer. Coal, as everybody knows, has been seeing some troubled times. In 1929 the total U.S. production of coal was 608,816,788 tons. In 1935 it was 420,327,000 tons, a decrease of 31%. During the same period the total revenue from coal mined decreased 32.3%. Meanwhile, with Government cooperation, the price of coal is raised. This is rich "duck soup" for the oil and gas men—particularly the latter who are out to take away from oil anything that oil may take away from coal in addition to making a direct attack on their own account.

Price the Handicap

Gas is now consolidating and extending its advanced positions. As the demand for fuel gas increases the price will come down and price at present is the greatest handicap of fuel gas.

We should not forget, however, that price comparisons based on the number of Btu delivered for a dollar, or for a cent, do not always express the real value ratios. The highest combustion efficiency may be obtained with gas at an equipment cost below that required to secure the same efficiency with either oil or coal. There is no nuisance handicap—no smoke, soot, dust or ashes where gas is burned.

"When you burn oil you burn gas." This is a slogan of one of the big natural-gas companies in the Southwest. Before oil can be ignited it must be raised to the ignition point, which is above its vaporization point. To put oil in condition to burn, some more or less expensive equipment is required and some heat must be applied to it. This costs something. If any part of the oil-burning equipment goes "haywire," trouble of various kinds will be ready for the tired home owner when he returns to his waiting household anticipating a good dinner and a quiet evening. Things can happen to oil and coal equipment that cannot happen to gas. The gas men know this and make capital of it.

When we burn a bituminous coal we are also burning a gas to some extent.

The entire fuel front—coal, oil and gas—is now moving forward rapidly in a planned advance toward greater efficiency. We have in the United States a huge and closely calculated reserve of coal. The known reserves of oil and natural gas will be exhausted within the lifetime of people now living. Undoubtedly the drills will discover new oil and gas fields, but where are those fields? I wish I knew.

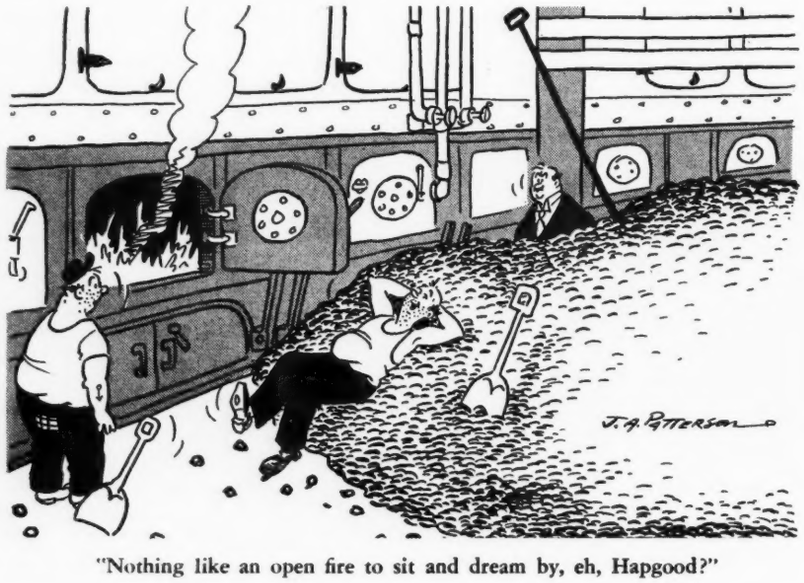
Coal is the ultimate fuel—coal reaching the heating and power plants in the form of gas.

Exhaust Lines

A new method of riveting, used in Germany, solves the problem of close-quarter work where it's hard to get at the shank. A small charge in the drilled out end of the shank explodes when an electrically heated dolly is held to the head; the resulting expansion of the shank makes the joint.

European engineers face a design problem that hasn't even been thought of by the average American power-plant designer—at least not yet. That's the job of bombproofing key power plants; designing them to maintain essential services in the midst of an air raid or a long-range artillery bombardment. Several such stations are rumored to have been built on the continent, from carefully guarded plans. Underground location seems to offer best protection, but involves all kinds of difficulties with fuel supply, flue-gas disposal, and water supply. A different plan was proposed in a recent issue of *The Engineer* by A J Hodgkinson, who suggests a building of dome shape, to deflect shells. Double walls of heavy reinforced concrete would be used, with considerable space between inner and outer shells. To isolate damage, the interior would be divided by barriers, and a bombproof shelter would house the operating crew.

World's largest refrigerating compressor, according to Ice and Refrigeration, ***is the 40,000,000-Btu-per-hr unit recently installed in Germany. A 4100-hp motor drives the unit.***



"Nothing like an open fire to sit and dream by, eh, Hapgood?"

New Diesel Plant—New Cooling Method

Evaporative condensers, borrowed from air conditioning practice, cool jacket water for Simonds Saw and Steel Co's 855-hp installation

AS a pioneer in the application of evaporative condensers to diesel-jacket-water cooling, and as a demonstration of the ability of modern engines and governors to meet severe industrial-load fluctuations, the new diesel plant at the Simonds Saw and Steel Co's file factory in Fitchburg, Mass. is outstanding among recent installations.

Back in 1832, another pioneer, Abel Simonds, founded at Fitchburg a company for the manufacture of knives and other edge-cutting tools. Now known as the Simonds Saw and Steel Co, with two factories in Fitchburg, one in Chicago, a steel plant at Lockport, N. Y., a saw-and-knife plant at Montreal, and a grinding-wheel plant at Philadelphia, its products are familiar to industry all over the country.

Preliminary Studies

At the file plant in Fitchburg, prior to 1937, all power was purchased, and a small steam plant provided high-pressure steam for process and building heating. Preliminary studies made by Francis J Sill, consulting engineer, Westboro, Mass., showed possible savings which made private generation of power seem desirable. The high ratio of power to steam load indicated that diesels were a logical choice if they could be counted on to maintain satisfactory regulation under the extremely heavy load fluctuations characteristic of the plant. Further, it was felt that a trial of diesels at this plant might reveal their applicability to other Simonds plants.

First step was the purchase, in 1936, of a 330-hp Winton engine which was installed in space available in the boiler room. This unit appears in the foreground of Fig. 1; the boiler is to the left of the engine, not visible in the picture. Fig 2 shows how the auxiliaries were disposed along the wall on the far side of the engine. Two major problems had to be overcome in this first installation: voltage regulation and jacket cooling. Each was solved, making later extension of the plant both possible and desirable. Let's take a look at these difficulties and see how they were surmounted.

Load swings result from a grinding operation in which a stack of files is brought into contact with the face of a large grinding wheel. As the wheel bites, there is a heavy demand for power, and with seven grinding machines, the possible peak due to simultaneous operation is extremely large. Load fluctuations were studied for an extended period with a high-speed recording wattmeter. The portion of the chart reproduced in Fig. 3 gives a

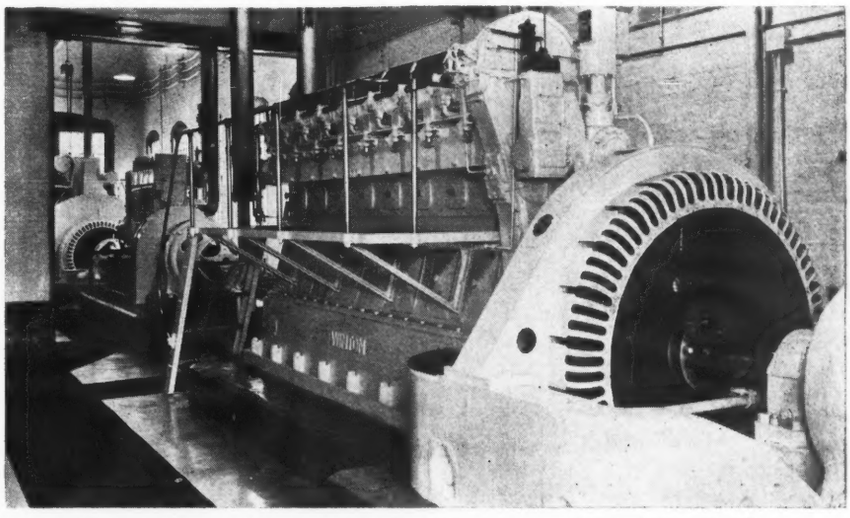


Fig. 1—First engine in Simonds plant was 330-hp Winton, in foreground. Two other units (in rear) were installed later

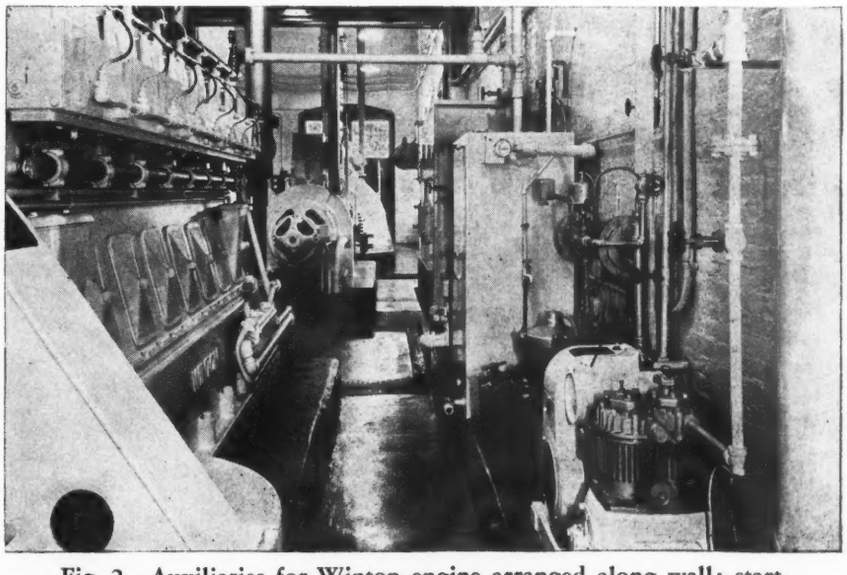


Fig. 2—Auxiliaries for Winton engine arranged along wall: starting-air compressor in foreground, followed by centrifuge, oil tank, and evaporative condenser

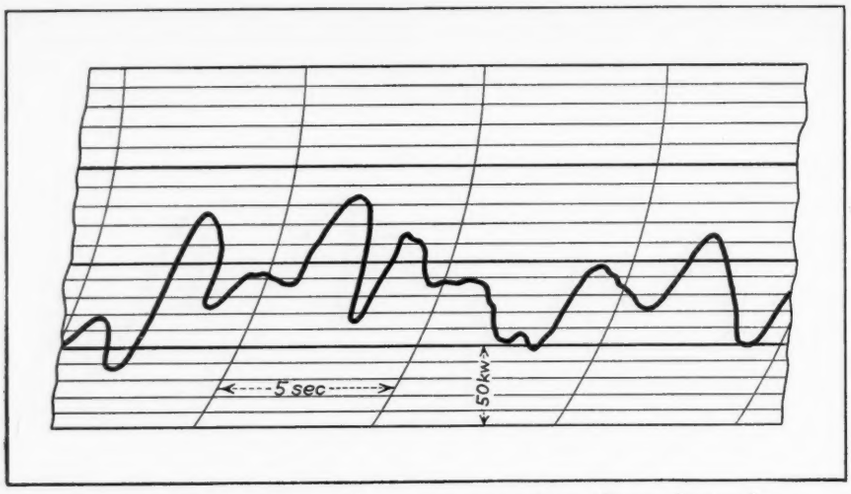


Fig. 3—Portion of recording wattmeter chart shows fluctuations in grinding-room load

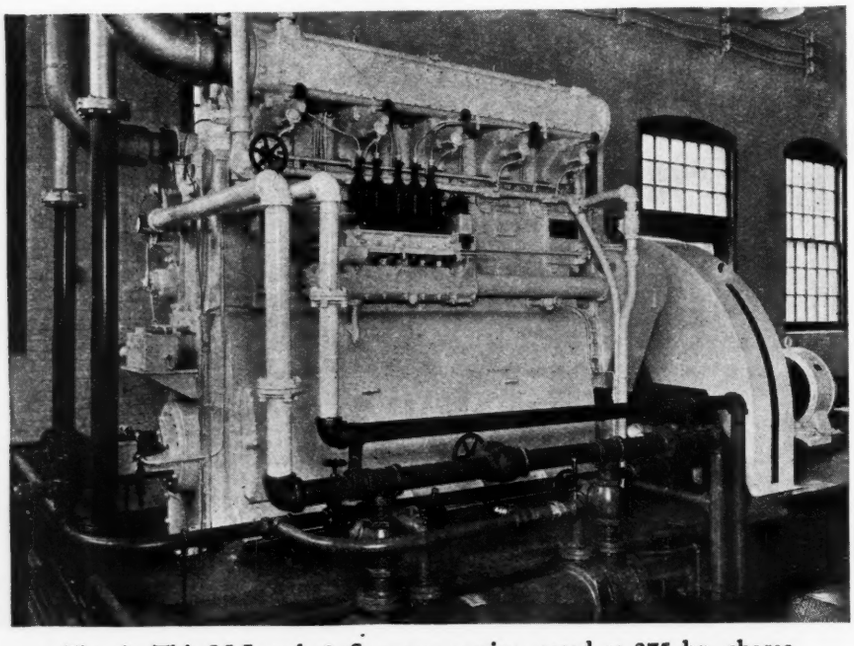


Fig. 4—This McIntosh & Seymour engine, rated at 375 hp, shares base loads with the large Winton unit

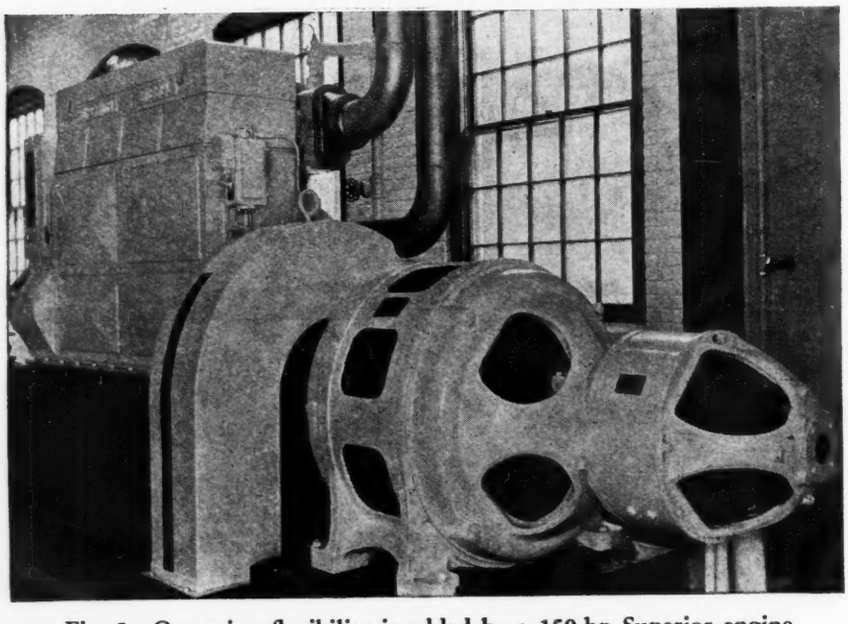


Fig. 5—Operating flexibility is added by a 150-hp Superior engine

rough idea of the variations in this grinding room load. The remainder of plant load is about 200 kw. Winton engineers believed their engine, with a Woodward governor, could meet these swings and maintain satisfactory voltage regulation. Operation in parallel with the utility system during 1937 demonstrated that this was so, and there was no reason to hesitate at cutting loose from outside service when additional engine capacity was installed.

Since all water for the file factory is purchased, some means of cooling and recirculating jacket water was essential to avoid heavy expense. The usual answer, a cooling tower, was ruled out because the only place where one could be installed was the boiler-house roof, which meant heavy reinforcement to support the added load. Experience with evaporative condensers in the air-conditioning field led Mr Sill to think of them as a possible solution to this problem, and with the cooperation of the Buffalo Forge Co, a highly satisfactory installation was made, believed to be the first of its kind. The cooling unit can be seen in Fig. 2, beyond the centrifuge and oil tank. A better idea of its appearance can be gained from Fig. 6, a close-up of another evaporative condenser installed to serve engines added later.

Cooling Jacket Water

Essentially a combination of shell-and-tube heat exchanger and forced-draft cooling tower, the evaporative condenser has been widely used in the air-conditioning industry in recent years. It is now a standardized product that can be bought "off the shelf" in a wide range of capacities. Strictly speaking, the term "evaporative condenser" is incorrect when the unit cools jacket water, since no condensing occurs. "Evaporative water cooler" would be more accurate, but since "evaporative condenser" signifies a particular type of apparatus to the reader familiar with air-conditioning equipment, this term has been used throughout the article.

The units installed at Fitchburg consist of a steel casing with an air intake in the lower front section. High-efficiency centrifugal fans, on a common shaft, V-belt driven from a protected motor outside, draw air through the casing. Inside is an extended-surface copper cooling coil with a spray header and eliminator plates above. A pump supplies water to the spray headers, taking its suction from a sump. A settling pan, below the coils, catches excess water; the overflow returns to the sump. This is a departure from normal practice, dictated by local conditions. The usual evaporative condenser has a built-in

pump, which circulates water from the settling pan to the spray header. Make-up is supplied to the settling pan under control of a float valve.

Operation of Cooler

Operation of the cooler is simple. Jacket water circulates in a closed path from the engine through the coils of the evaporative condenser and back to the engine. Kept wetted by the spray header, the cooling coils are in the path of a steady stream of air. Heat flows from the jacket water through the extended-surface coils to the spray water outside; the spray water is warmed above the dewpoint of the air and evaporation occurs.

By utilizing the latent heat of evaporation, advantage is taken of the total heat capacity of the air, which is nearly five times as great as the sensible heat capacity. In addition, the dry-bulb temperature of the air increases only slightly or may even decrease, thus maintaining a much greater temperature differential across the coil than could be obtained with a dry cooler. Based on an average jacket-heat removal of 3000 Btu per hp hr, and a jacket water differential of 20 F (from 120 F to 140 F), evaporating 0.75 gpm will cool 100 diesel hp.

Several advantages are claimed for this method of jacket cooling. Most obvious is water saving. Also, since cooling is by evaporation and not straight heat transfer, water at any temperature may be used for cooling. These advantages can be obtained, of course, with cooling towers. The closed circuit for the jacket water means freedom from contamination and close control of hardness. Scale formation is eliminated and there is little possibility of "hot spots" or cracked cylinders. These are advantages common to all double-circuit cooling systems. The special virtue of the evaporative condenser seems to lie in the combination of these features in a single, standardized unit of low first cost. Compactness and ease of installation were other deciding factors in this particular case.

Extending the Plant

Satisfactory solution of problems attending the installation of the first engine made it possible to follow the logical course, and extend the plant. During 1937, two more engines were installed and the boiler was converted to oil firing. Since January 1, 1938, the plant has operated independently of the utility system.

All engines are 4-cycle, mechanical injection units with Woodward governors. The Winton, an 8-cyl, 10x14-in., 400 rpm unit, drives a 225-kw, 0.8-pf, 240-volt, 3-phase, 60-cycle General Electric generator with direct-connected exciter. A 250-kw Westinghouse generator, of similar electrical characteristics, is powered by a 5-cyl, 12½x18-in., 375-hp McIntosh & Seymour engine running at 360 rpm. A 150-hp, 4-cyl, 9x12 in., 514-rpm Superior unit direct-connected to a 100-kw Westinghouse generator and exciter, completes the engine-room picture. Addition of the latter units required an extension of the building. Engines rest on heavy concrete slabs set on sand in foundation pits; transmitted vibration is neglible.

To reduce congestion in the boiler room and facilitate servicing, air is brought in through Staynew dry filters equipped with Powers regulating

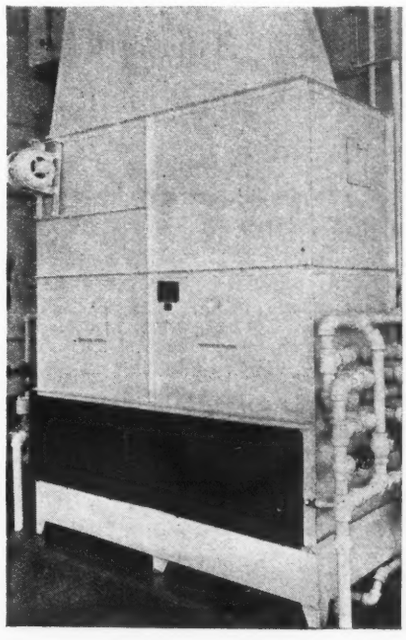


Fig. 6—This evaporative condenser cools jacket water for more than 500 diesel hp

mounted on the roof. These units receive regular inspection and cleaning and as yet no replacements have been required. Exhaust gas is piped directly to Maxim silencers mounted horizontally on the roof. Vertical exhaust pipes have flexible hose sections to cut down vibration transmission.

Each engine has a 100-gal. day tank, but no storage tanks were required since the engines are running on No. 4 oil bought for heat treating, and storage tanks for this purpose were already in existence. Consideration has been given to use of a cheaper oil in the engines, but it is doubtful if the savings would justify the additional storage facilities required and the higher maintenance costs that would probably result.

It is too soon to have accurate figures on lubricating-oil consumption, but all indications point to exceptionally good performance. Steam preheaters (Ross), valves, raise oil temperature to 190 F before centrifuging in Goulds Hydroil units.

The evaporative condenser seen in Fig. 2, equipped with a 2-hp motor for fan drive, cools jacket water from the Winton. The cooling unit shown in Fig. 6 is larger, powered by a 3-hp motor, and serves the Superior and McIntosh & Seymour engines. Both units are set against outside walls; the first discharges from the upper rear directly through a louvred opening in the wall, the second from the top through a short duct leading outside. Spray water is taken from a sump into which all clean plant waste water drains. The main source is water from the electric furnace and air and ammonia compressor jackets; water temperature averages 80-90 F.

No difficulty has been encountered at any time in maintaining desired jacket-water temperatures and a trial has shown that if water supply fails, the engines can run about two hours on straight air cooling, without exceeding recommended upper limit of temperature. The coolers tend to be self-regulating since capacity increases or decreases with changes in jacket-water temperature at entrance. Differences between summer and winter weather conditions are taken care of by a hand-regulated bypass.

Switchboard

The switchboard, which faces the generator of the Winton unit, consists of three generator panels and a synchronizing bracket including a voltage regulator. Equipment was furnished by both G E and Westinghouse. Generator sizes are such that major load variations during the 2-shift working day can be met economically, and the small night and weekend requirements are met by an Exide storage battery of 60 cells.

As a part of the power program, the existing 1500-sq ft hrt boiler was modernized. Rebuilding the setting and installing Hammel equipment for burning Bunker C oil increased its efficiency and capacity. It now supplies steam at 120 lb for sandblasting, and at reduced pressure for heating various buildings.

Outstanding general feature of the plant is the striking appearance resulting from painting engines, boiler, auxiliaries and piping pure white, combined with battleship gray on floors and foundation slabs. Credit for the spotlessness of the plant goes to C B Newell, Chief Engineer, who agrees with the Simonds management that a clean, good-looking plant is an incentive to sound operation. Everything seen during a recent visit by one of *Power's* editors attests to the correctness of this point of view.

Single-Retort Screw-Feed Stokers

Here's what you need to know about automatic coal-burning equipment for small boilers. This article is the first of a series on construction, installation and operation of modern stokers

By L N ROWLEY
Assistant Editor

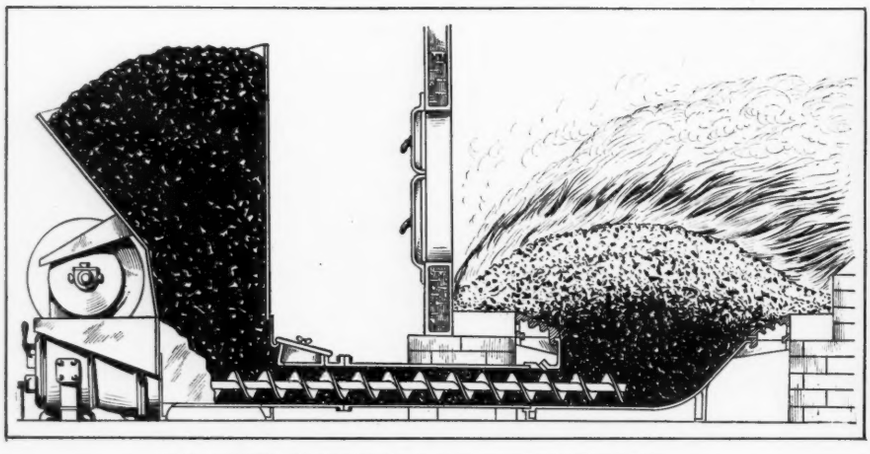


Fig. 1—Typical single-retort screw-feed stoker

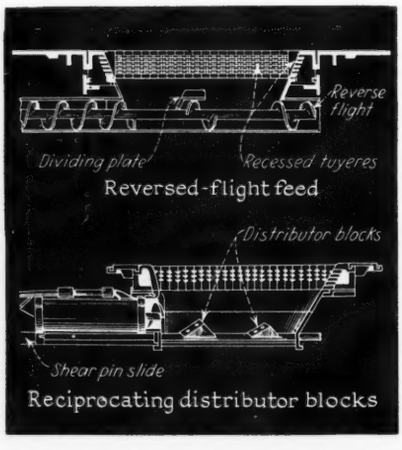


Fig. 2—Distribution within retort

INDUSTRIAL stokers are available with coal-burning rates as low as 100 lb per hr, suitable for boilers of 250 sq ft. From this size up to about 1200 lb per hr, the single-retort screw-feed stoker is widely used. Normally sold as complete units with fan and essential controls, these compact devices may be applied to almost any boiler with a minimum of alteration, bringing the proven advantages of mechanical firing to even the smallest plant.

In the typical unit, Fig. 1, a feed screw moves coal from hopper to retort, where air is admitted through tuyere blocks. Moving from retort bottom to fuel-bed top, coal is preheated and volatile gas is driven off and burned. Coked coal burns at the fuel-bed surface; clinker slides to dead plates or dump grates for periodic removal. Essential elements are hopper, feed screw, retort and grates, fan, drive, and controls.

Hoppers—Capacity varies from about 375-600 lb for 100-lb-per-hr units, to 750-2000 lb for 1200-lb-per-hr units. Most depend on slope of sides to avoid arching of coal, some are equipped with agitators. Offset hoppers permit easier access to boiler front for cleaning fires.

Feed Screws—Most are cast steel, alloyed for strength and resistance to abrasion. One maker employs a rolled-steel worm; another combines separate flights to form the screw. Feed tubes may be cast or drawn. To prevent packing of coal, some feed screws have the flights near the retort farther apart than those at the hopper. In large units, with long retorts, even feeding over the length of the retort is sometimes obtained by auxiliary reciprocating pushers in the retort bottom or by a reverse flight at the retort end of the feed screw, Fig. 2.

Retorts and Grates—In small sizes, retorts are nearly square, sometimes surrounded by dead plates. Sectional tuyere blocks allow for expansion and make replacement simple. Many blocks are high and slope away from the retort, making flow of clinker easy. Other units have recessed tuyeres below dead-plate level—see reverse-flight retort, Fig. 2.

Increased retort length marks larger units; live plates, admitting small quantities of air and increasing active grate area, replace dead plates in many cases. Extended tuyere sections form the live plates in some units. Dump plates are standard on many of the largest units and are optional on others. Fig. 3 shows how air flow is zoned to insure distribution in proper quantities to various parts of fuel bed; the unit shown has moving grate bars.

Fans—Integral multivane fans, with cast or built-up wheels, supply air, through a cast-iron or sheet-steel duct paralleling the feed tube, to a built-in windbox surrounding the retort. Several units have independent fan and motor assemblies. Volume is usually controlled by manually adjusted inlet or discharge dampers. Some units feature automatic devices for regulating air flow to match fuel bed requirements.

Drives—Constant-speed motors power virtually all stokers of this class. Most units employ a mechanical transmission for speed reduction and speed change; some use hydraulic transmissions. Average motor size runs

slightly less than 0.6 hp per 100-lb-per-hr coal rate, on small units; slightly more for large. Some large units have separate motors for fans and feed screw; hp figures include both.

Transmissions—Major speed reduction in mechanical transmissions is by worm and wheel; motor may be direct-connected or V-belted to worm shaft. Continuous-feed transmissions resemble automotive gearboxes and have 2, 3 or 4 speed changes, plus neutral. Speeds can be changed with feed screw in motion. Ratchet transmissions produce a pulsating feed. The worm-wheel shaft drives an eccentric actuating a pawl-and-ratchet-wheel combination, which drives the feed screw a fraction of a turn at a time. By masking teeth on the ratchet wheel or changing the pawl motion, speed changes are effected; 3-5 are customary, but one double-ratchet transmission makes 10-12 changes.

In hydraulic transmissions, a constant-speed motor drives an oil pump which feeds oil under pressure to a piston driving the feed screw through ratchet gearing. Adjusting the ratchet mechanism effects speed changes.

Overload Protection — Most feed screws float in feed tubes without bearings, and are connected to the transmission shaft by jaw clutches, flexible couplings, or universal joints. Shear pins provide for overloads caused by obstructions or binding of the feed screw. Some units have overload relays and alarms for the same purpose; some have both pin and relay. One has a switch which shuts off motor when pin fails; another can be fitted with an alarm signal to warn of pin failure. A relief valve in the oil-supply line takes care of overloads on hydraulic transmissions.

Controls—Simplest method of operation is by on-off cycle, with coal feed set at highest suitable rate and air supply adjusted to give fuel bed depth required. Stoker motor switch is under control of thermostatic relay on heating boilers; a pressure-actuated relay is employed on power boilers. Under light-load conditions, with long intervals when the stoker feed is off, the fire must be maintained by occasional feeding. A timer relay will start the motor at intervals, independent of other controls, or a thermostatic device in the stack can be used to start the motor when low stack temperature indicates the fire is burning out. Safe operation requires a low-water cutout, a boiler-pressure or temperature-limit switch, and a device for shutting down coal feed if the fire goes out.

Greater efficiency is claimed for stokers which automatically proportion air to coal feed. These devices may (1) adjust air supply to resistance of fuel bed, (2) maintain a constant volume of air in the combustion zone, (3) govern rate of fuel feed by change in windbox pressure with air volume fixed for the burning rate desired. Another system of control varies ratio of running time of fan and feed motor (where separate fan and motor are employed).

Coal—Most makers recommend free-burning coal, 1½-2-in. screenings with not more than 25-50% fines. Ash should be less than 10%, sulphur less than 2%. Many units will burn coking or caking coals, and some can be adapted to burn lignite and Rocky Mt. coals.

The next article in this series will discuss ram-feed stokers.

The following manufacturers of single-retort screw-feed stokers cooperated in furnishing the data on which this article is based: Anchor Stove & Range Co, New Albany, Ind.; Wm Bros Boiler & Mfg Co, Minneapolis, Minn.; Butler Mfg Co, Kansas City, Mo.; Canton Stoker Corp, Canton, Ohio; Combustion Engrg Co, New York, N. Y.; Conco-Sampsel Stoker Corp, Mendota, Ill.; Cotta Transmission Corp (Econocol Stoker Div), Rockford, Ill.; Economy Stoker Sales Co, Salt Lake City, Utah; Fairbanks-Morse & Co, Chicago, Ill.

Frederick Iron & Steel Co, Frederick, Md.; Holcomb & Hoke Mfg Co, Indianapolis, Ind.; Illinois Iron & Bolt Co (Free-man Stoker Div), Chicago, Ill.; Iron Fireman Mfg Co, Cleveland, Ohio; Kolmaster Corp, Oregon, Ill.; Link-Belt Co (Stoker Div), Chicago, Ill.; Moloch Fdry & Mach Co, Kaukauna, Wis.; Perfection Grate & Stoker Co, Springfield, Mass.; Rosedale Fdry & Mach Co, Pittsburgh, Pa.

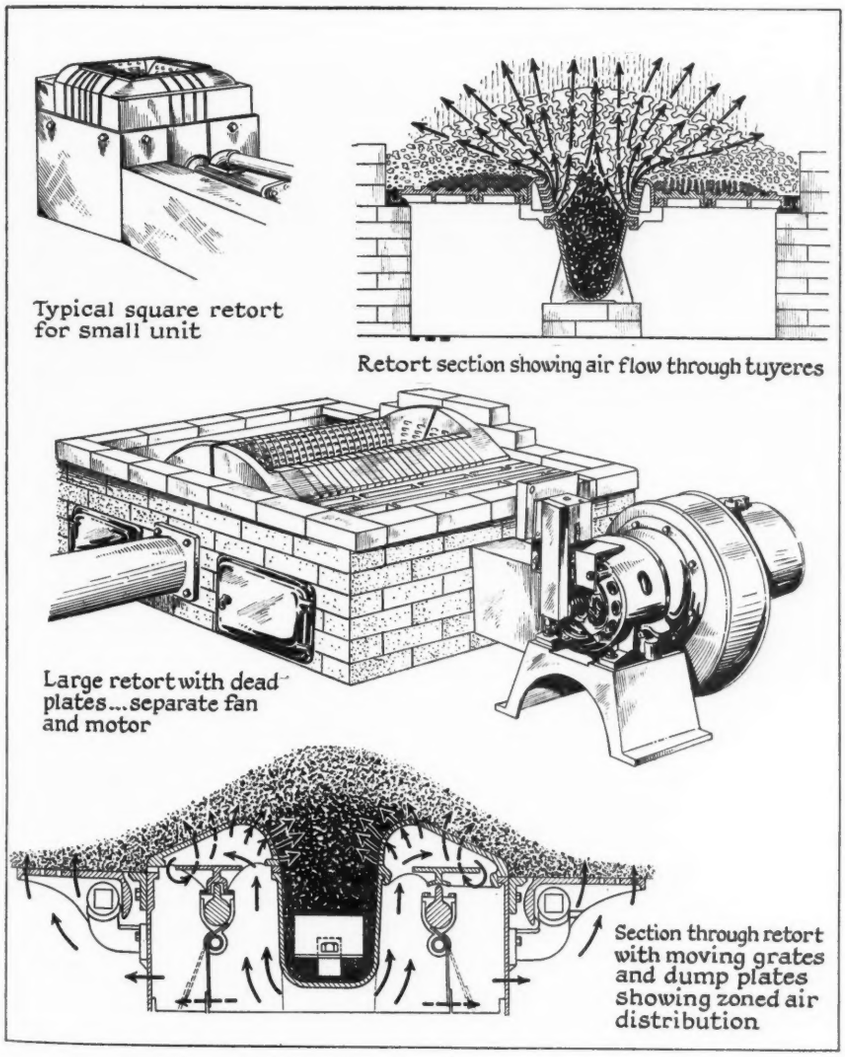

Typical square retort for small unit
Retort section showing air flow through tuyeres
Large retort with dead plates...separate fan and motor
Section through retort with moving grates and dump plates showing zoned air distribution

Fig. 3—Typical retort and grate arrangements

THE *only way in which one human being can properly attempt to influence another is by encouraging him to think for himself, instead of endeavoring to instill ready-made opinions into his head.*—Sir Leslie Stephen

Selecting DMV's

May *Power* discussed types and operation of diaphragm-motor valves. This article shows what must be incorporated in a valve and its control to obtain a unit best suited to a particular application

By E H HAMMOND

Chief Engineer, American S & B Instrument Div, Manning, Maxwell and Moore, Inc

A DIRECT-ACTING diaphragm motor valve (dmv) closes with increased pressure on the diaphragm, Fig. 1. The spring opens the valve as pressure on the diaphragm is released. This design is used wherever safety requires the valve to open wide in case of diaphragm rupture or air-supply failure.

A reverse-acting diaphragm-motor valve opens with an increased diaphragm pressure and the spring closes the valve as diaphragm pressure is reduced. Such valves are used where they must close in case of diaphragm rupture or air-supply failure.

Diaphragm-motor valves are roughly classified as either quick-opening, or as gradual-opening, full throttling. The quick-opening may be bevel seated (poppet type), Fig. 1, or of the low-lift V-port type. The gradual opening may be either the high-lift V-port type, Fig. 2, or a parabolic type, Fig. 3. Wire drawing is the most destructive action on a valve seat as most valve users will ruefully testify, and results from high-velocity flow when the valve disk is just off its seat. This action is particularly severe with an over-sized bevel-seated valve that must work either on or just off the seat. To reduce wire-drawing and to give a graduated, full-throttling control requires a valve with high-lift characteristics for low flows. With such a valve, even for very small flows, the valve and disk are immediately separated, thus decreasing cutting or wearing action on the seat. This also tends to eliminate over-control, and destructive chattering of the valve disks on the seats.

Wide flexibility when controlling large as well as small flows is a requirement of a good dmv. Valve range of control will be partly determined by flow design of valve passages, and partly by the throttling characteristics of the inner valve. High turbulence and eddy currents, due to poor valve design, will cut down valve capacity at higher flows, and decrease its range by taking control away from the inner valve before its full capacity is reached.

Likewise, the throttling characteristics at very small flows will be determined by lift-flow relationship of the inner valve. For wide flow range the orifice or port should do the controlling, from minimum flows to maximum wide open port. The valve must be able to throttle the smallest flow required without over-traveling and starting a flow-surge. It should not, when first opened, permit too great a flow, followed by a quick closing, and then a surging cycle of opening and closing. Instead, the valve should throttle small flows so that flow varies with demand.

Selecting a DMV

(1) If possible choose the valve size so that the valve will not have to be more than 60 to 75% open at normal flows.
(2) Specify the proper trim. If in doubt consult the manufacturer of the valve.
(3) Specify the body material. Does the use of cast iron constitute a fire or explosion hazard.
(4) Be sure the pressure rating is not exceeded.
(5) Will all the specified pressure drop be available across the valve, or is line and equipment drop included.

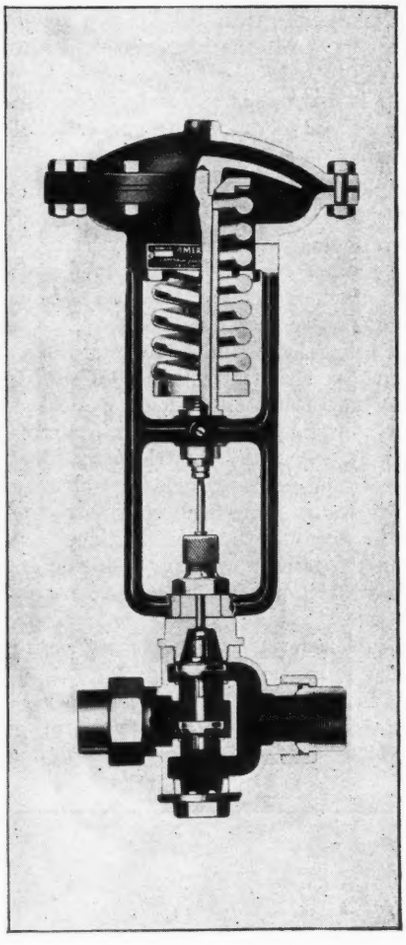


Fig. 1 — Conventional diaphragm-motor-operated valve, with quick-opening beveled seat

It should be recognized that minimum flow that can be handled by any valve is limited. Below this minimum, good control will be sacrificed, and surging and wire drawing will probably result. The actual range will, of course, depend on size, type, and design of valve, and should be recommended by the manufacturer. If the control range is too great for a particular valve, it is better to select a smaller size to handle low and normal flow, and provide other means such as a manual bypass for handling maximum loads that occur rarely.

On severe control-range requirements, where the control must be fully automatic at all times, install two dmv's in parallel. Set the valve springs so that the second valve will not start lifting off its seat until the first is wide open. This arrangement provides accurate control at low flows and gives large capacity for maximum flows.

Liquid capacity of a dmv varies as the square root of pressure drop across the valve. For non-critical steam, air,

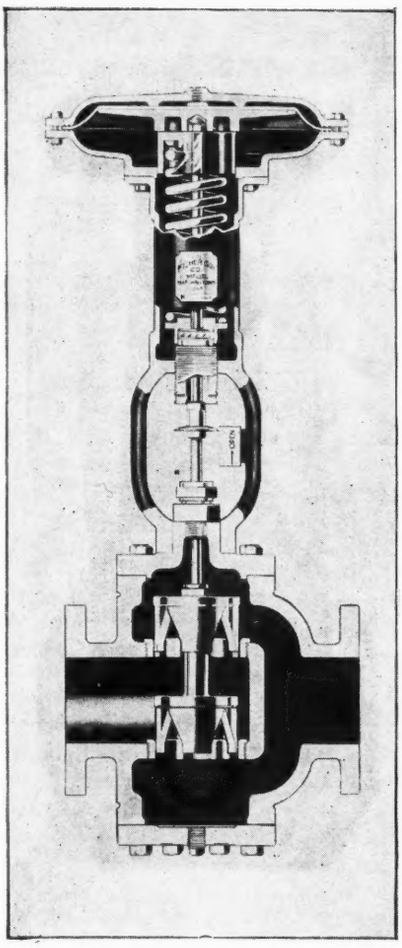


Fig. 2 — High-lift, direct-acting double-seated valve with throttling V-ports and preformed diaphragm

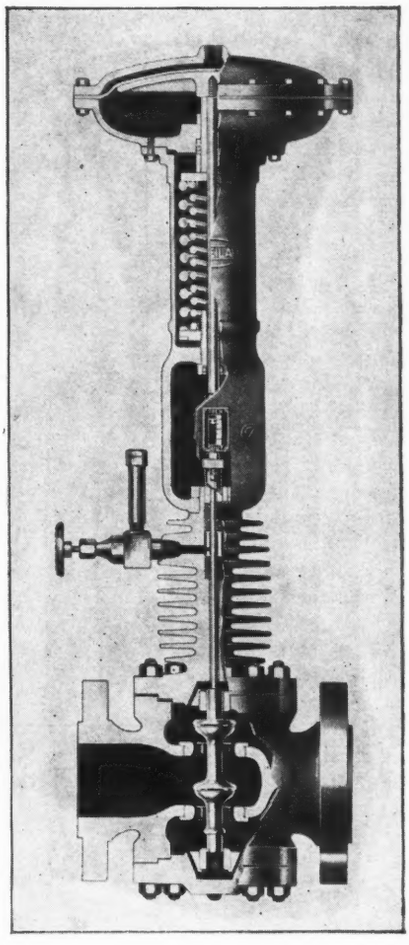


Fig. 3—Gradual opening, direct-acting valve with parabolic valve plug, grease seal, air-cooled stuffing box

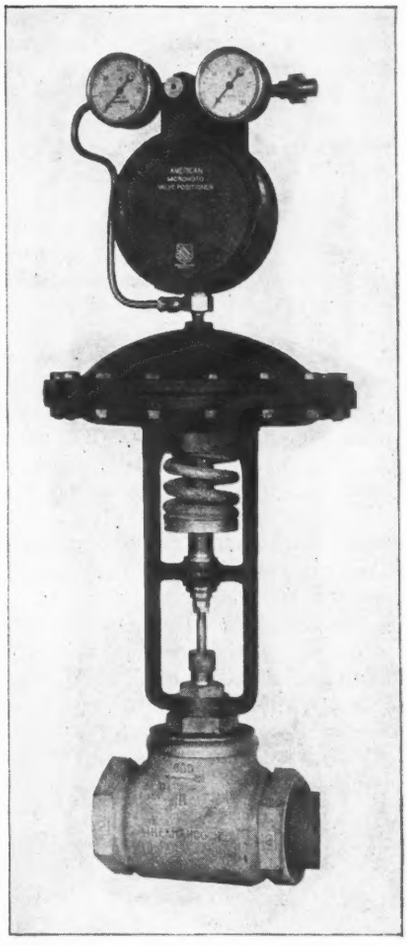


Fig. 4—Valve positioner controlled by air pressure, attached to diaphragm of a diaphragm-motor valve

or gas flow, capacity varies as the square root of the product of pressure differential and low-side pressure; and for critical flow, capacity varies directly as high-side pressure. Liquid and gas capacities must be corrected for specific gravities or temperatures other than standard; steam flows must be corrected for quality or superheat.

Most manufacturers provide capacity curves or charts for their dmv's, which give maximum flow for specified conditions. The valve should be selected so that it will normally be not more than 60 to 75% open. Capacity of a double-ported valve is greater than a single-seated valve of the same nominal pipe size, but it will not have twice the capacity, everything else being equal.

Check Pressure Drop

Capacity of a valve will depend on the pressure drop across it. Therefore, when laying out a piping system, or when selecting a dmv for a present installation, the available pressure drop should be carefully checked. Otherwise the valve will not be the correct size. For example, consider a simple installation where liquid is heated by closed steam coils, with the condensate trapped. The steam-header pressure may be 100 lb per sq in. and the trap may be discharging to atmosphere; but this does not mean that the available pressure drop across the dmv will be 100 lb.

Some pressure will be lost in the steam piping between the header and the heater; there will be additional pressure drop through the steam coils; and finally some pressure will be required to force the condensate through the trap. Assume the piping drop as 15 lb, the coil drop as 10 lb and the trap drop as 20 lb—a total of 45 lb. This leaves only 55 lb available as pressure differential across the valve, and this is the drop which will determine the valve size, or its capacity.

Service Questionnaire for DMV's

When ordering, or specifying a dmv, submit as much as possible of the following information:

(1) Nature of flowing fluid; is it corrosive or erosive in action?
(2) Variations in flow (minimum, normal, maximum).
(3) Allowable pressure drop across valve (minimum, maximum, normal).
(4) Initial, or high-side pressure, and maximum pressure.
(5) Flowing temperature, and maximum temperature.
(6) Gravity—API, Be, or specific (referred to air or water).
(7) Can valve be operated with a manual bypass?
(8) Should valve be direct or reverse acting?
(9) Can valve be double-ported, or must it dead-end?
(10) Is service throttling, or open and closed?

Installing Valves

Install the dmv in the straight run of a bypass, with a hand valve on either side and with a throttling valve in the bypass, Fig. 5. The bypass permits hand control while starting up or shutting down the controller, and also permits the valve to be removed for maintenance work. Usually the dmv will be one or more sizes smaller than the pipe line, and the bypass valve can be made the same size as the dmv. It is good design, when reducing from line to dmv size and

back to line size again, to use swaged nipples or bell reducers to minimize friction drop.

Install the valve where it is accessible for inspection, packing, and general maintenance. There should be a shut-off valve in the air line to the diaphragm chamber. It is better to install the dmv vertically. It will operate in a horizontal or inverted position but wear on moving valve parts is likely to be greater than when installed in a vertical position.

The range of single-seated valves can be increased by using a valve positioner which permits a higher pressure differential across the valve. A valve positioner is a mechanism which is attached to the dmv, Fig. 4, and is actuated jointly by the travel of the valve and by air pressure from the controller. By regulating the air pressure to the diaphragm it sets up and maintains an exact proportionality between the air pressure from the controller and the travel or position of the valve. The valve positioner compensates or corrects for friction, off-balance thrust, hysteresis of the diaphragm and spring, and the changes in effective area of the diaphragm (within the limit of the available diaphragm power).

In addition to widening the operating scope and improving the control when used with single-seated valves, the valve positioner makes easier the work of the controller with double-ported valves on those services and applications where an extreme nicety of control is required.

Photographs, Fig. 2 is Fisher Governor Co; Fig. 3, Mason Neilan Regulator Co; and Figs. 1 and 4 American S & B Instrument Div, Manning Maxwell and Moore, Inc.

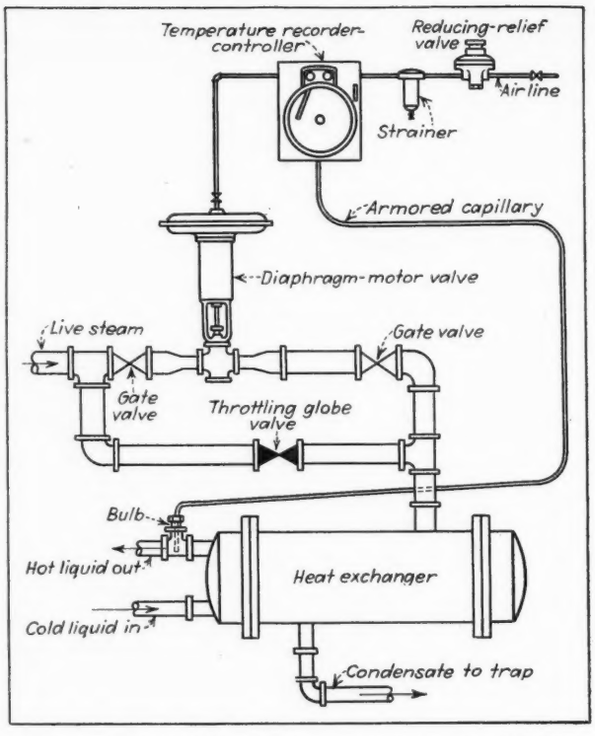


Fig. 5—Typical diaphragm-motor-valve installation controlling steam to heat exchanger

Grading Welders

The arcronograph, highly developed electrical recording meter, can be used to supplement usual physical tests in welding-operator qualification

By D H COREY
Welding Engineer, The Detroit Edison Co

THE DETROIT EDISON COMPANY began rebuilding Conners Creek in 1933. That year also marked the adoption of arc-welded joints by the company for piping systems operating at high pressure and high temperature. Throughout that rebuilding program and the subsequent installation of new generating equipment in Delray No. 3, arcronographs * have been used as an inspection aid in welding all field piping joints for severe-service conditions.

To acquire experience in interpreting arconograph charts, further use was made of these instruments for all experimental and operator-qualification test welds. Since all such welds are subjected to destructive tests in determining physical properties, including soundness, this practice offered opportunity for correlation between weld properties and arcronograph charts which could not be had in regular field construction.

From experience thus gained, we believe that arcronographs can be used to advantage in classifying welders. We have noticed a striking difference in the appearance of charts produced by welders whose welds meet the requirements of the qualification test as to physical properties, and of those whose welds do not meet the requirements.

The three sections of charts shown are from three welds, each made by a different operator. Each chart section is representative of the entire chart from which it was taken. Chart "A" is typical of a sound weld for the brand of electrodes used. Deposition of two complete electrodes and parts of two others is shown, the three full-scale deflections being interruptions for changing electrodes. Chart "B" is marked by a succession of "starts and stops," with short intervals of satisfactory welding. Chart "C" is extremely ragged, with even shorter intervals of sound welding.

Physical properties of the three welds are shown in Table I. It will be noted that all welds were satisfactory from the standpoint of strength and ductility. However, only "A" was satisfactory from the standpoint of soundness. It has been our experience that defects ordinarily encountered in welds made under a carefully controlled procedure are not of sufficient size to affect the tensile or bend properties under static loading. Soundness tests appear to be the best basis for judging comparative skill among a group of welders. A correlation between the three arcronograph records and the soundness tests is apparent. This correlation exists, even

* For a description of the instrument, and a discussion of the theory upon which it operates, see "The Evolution of the Arcronograph" by Bela Ronay, Journal of the American Society of Naval Engineers, August, 1934.

though each layer of deposited weld metal of all three welds was thoroughly cleaned and all visible defects removed.

No record is available of the distribution of total elapsed time required to make each joint as between welding time and cleaning time, but we feel sure, from extended observation, that much of the excess time spent in completing the "B" and "C" welds was consumed in chipping out defective work. Had the same amount of time been devoted to the "cleaning" of each weld, the correlation between the arcronograph records and the soundness tests would have been more striking.

Not a Substitute

This discussion is not to be interpreted as a proposal to substitute the arcronograph for physical-property tests in the qualification of welding operators. The purpose is simply to point out that, in the experience of the author's company, the arcronograph has been found a useful aid in classifying welders' ability to produce sound welds under field conditions.

Simple recording meters, either ammeters or voltmeters, have not given as satisfactory results. Such meters respond to incorrect welding conditions, such as an unduly long or short arc, only in proportion to the actual change in arc current or voltage. The arcronograph, however, exaggerates defects by giving a full-scale deflection whenever welding conditions are not within predetermined limits, fixed by relay settings. Furthermore, the recording ammeter or voltmeter, unless supplemented with auxiliary equipment, produces a continuous chart throughout the day. Under field-welding conditions, only a small part of the elapsed time devoted to a joint is spent in actually depositing weld metal. Thus the provision whereby the arcronograph is operative only during actual welding, reduces greatly the amount of chart to be handled.

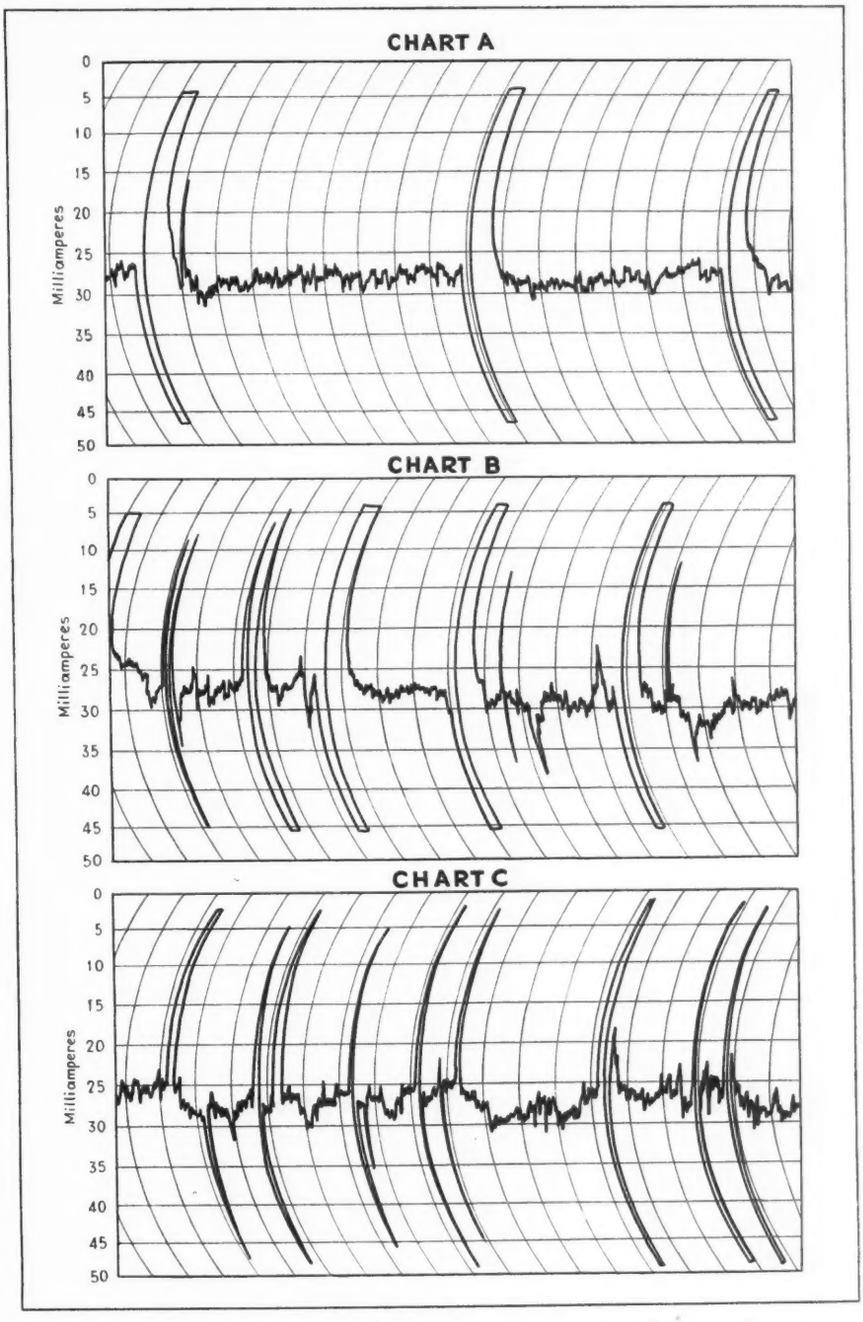


Fig. 1—Three chart records indicate degree of weld soundness: *A*, good welding; *B*, spotty; *C*, poor quality

TABLE I — PHYSICAL PROPERTIES OF WELDS

Weld	Tensile Tests: Yield Point lb sq in.	Tensile Tests: Ultimate Strength lb sq in.	Bend Tests: Elongation of Outer Fibres, Per Cent	Nick = Break Tests: Number of Slag Inclusions	Nick = Break Tests: No. of Visible Defects: Per sq in.	Nick = Break Tests: No. of Visible Defects: Over 1/16 in. dia	Time for Making Joint Hours
A	43,700	74,500	46	0	1	0	
	50,800	72,800		0	3	0	8
	41,000	74,450	49	0	1	0	
Avg	45,200	73,900	48				
B	43,800	72,800	57	0	2	0	
	50,400	63,400		0	10	0	20
	43,400	70,600	57	0	4	1	
Avg	45,900	68,900	57				
C	40,100	71,800	46	1 (5/16 in. long)	7	1	
	41,700	72,600		0	7	0	12
	46,500	70,300	50	1 (9/16 in. long)	5	2	
Avg	42,800	71,600	48				

One Does the Work of Two

Sloane-Blabon Corp., by replacing two old boiler plants with two stoker-fired boilers under one roof, improves operating efficiency about 20%

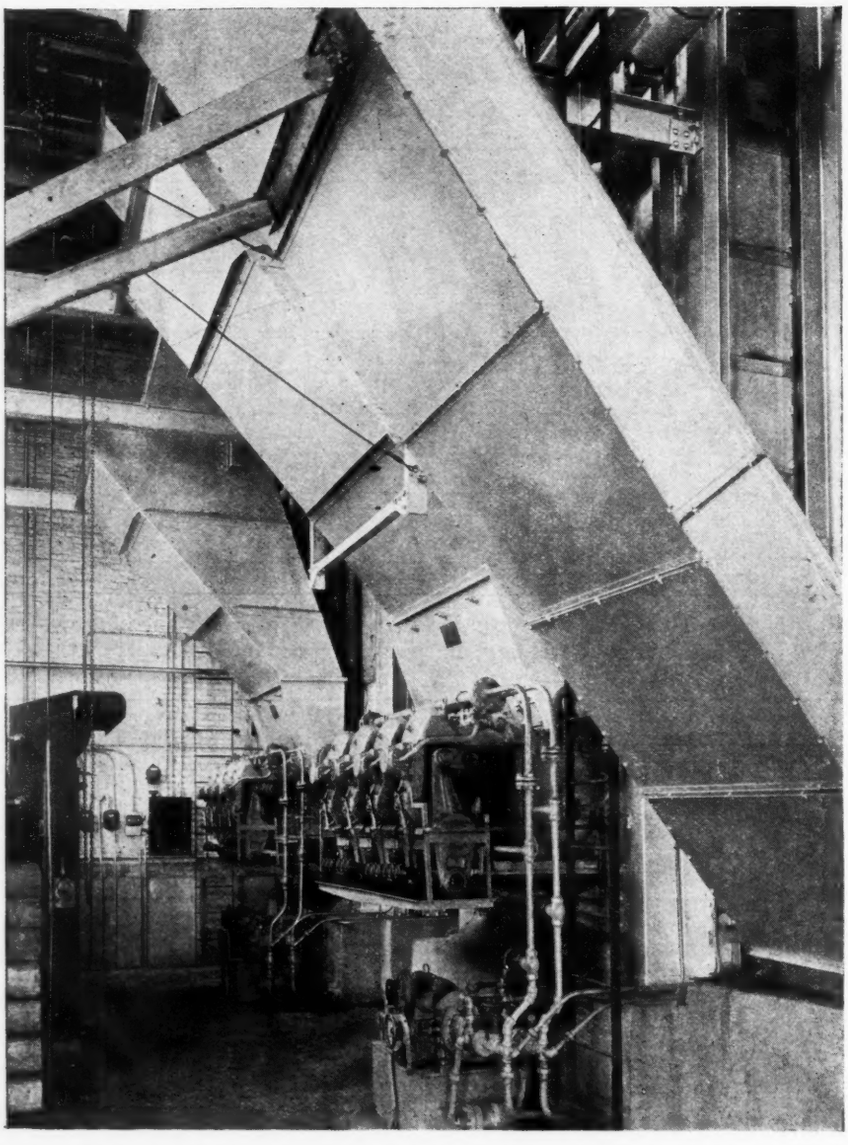


Fig. 1—Underfeed water-cooled stokers are driven by hydraulic plungers operated by Hele-Shaw variable-displacement pumps

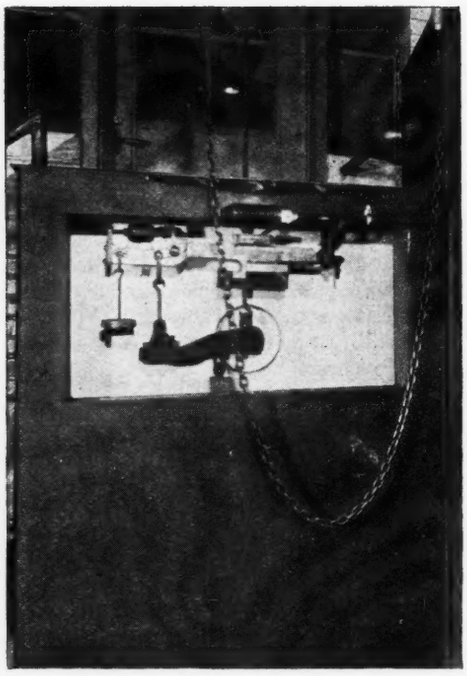


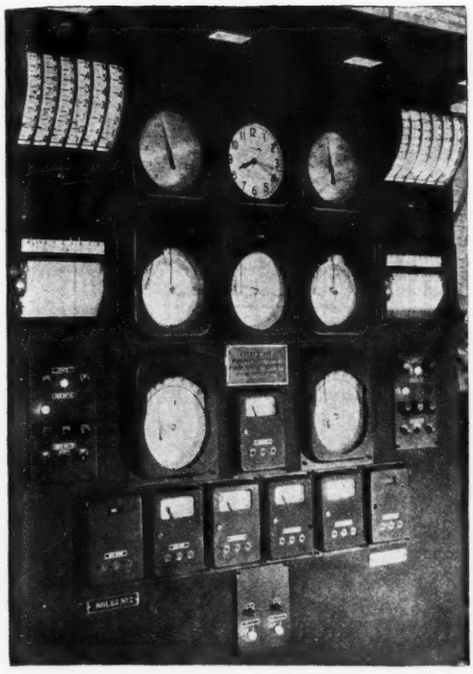
Fig. 2—Here are centered meter and automatic-combustion-control

WHEN all power for an industrial plant can be produced as a by-product of process steam, it is more economical to generate than purchase power. This, though an axiom with power engineers, is not always the answer to the power problem. Local conditions may make it desirable to purchase power, even though generation in an isolated plant would be cheaper. This was the case at the Sloane-Blabon plant (one of the largest manufacturers of linoleum in the U.S.), Philadelphia, Pa., where solely a high-pressure boiler plant was installed.

Steam demands at this company's Philadelphia plant had reached such proportions in 1934 that enlargement of steam-generating capacity had to be considered. At that time, steam was generated in two old boiler plants; one with 5 hand-fired boilers and the other with one 6430-sq ft stoker-fired boiler. All power was purchased.

Former Coal Handling

Coal was received by rail and stored in a yard some distance from both boiler plants. In the yard, it was loaded onto a truck, transported to the plants and dumped on the boiler-room floors. It was then shoveled by hand into the boiler furnaces in one plant and into the bucket of a small hoist that delivered the coal into the stoker hopper of the other plant. Obviously, this arrangement was unsatisfactory and uneconomical, because of high handling costs and the dirty condition created by the coal-handling method. Having two boiler plants also made for unsatisfactory operation.



panel, coal scale and weigh-larry control for convenient operation

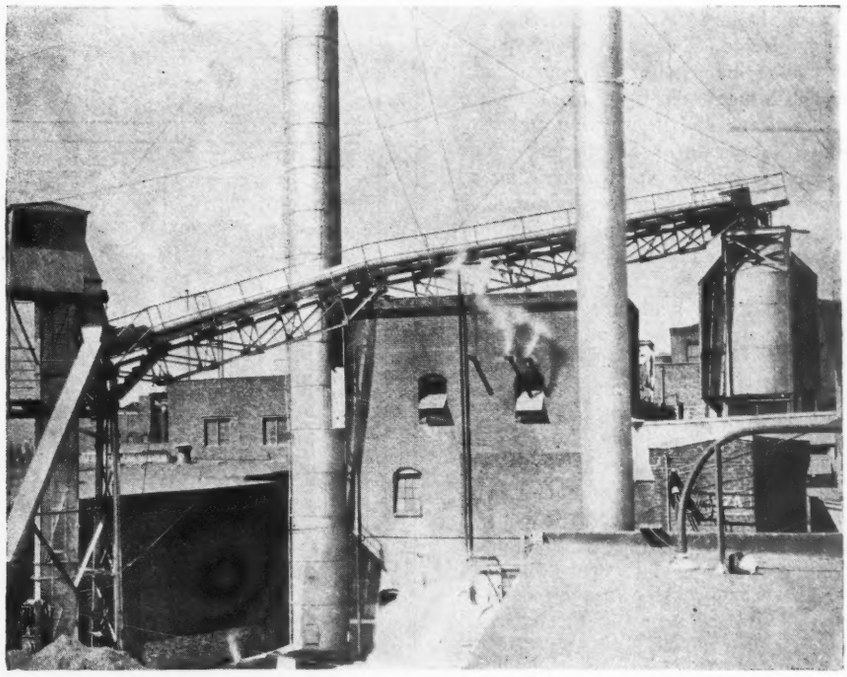


Fig. 3—Coal is received by rail (at left) and delivered automatically into the vertical coal bunker (at right) above the firing aisle

Engineering studies of how to increase most economically steam-generating capacity and provide for future expansion were made by the company's engineering department under R R Frederick, plant engineer. Several plans were investigated before the choice of a new boiler plant was made.

The first proposal was to install water walls in the furnace of the stoker-fired boiler so that it could be operated at higher ratings. This would take care of winter-peak steam requirements, but would leave the coal-handling problem unsolved. It also required operation of the two boiler plants.

Space was available in an old boiler plant beside the stoker-fired boiler, from which boilers had been removed, to reset two of the largest old hand-fired units. A study was made of the possibility of installing these two in high settings to burn pulverized coal, retaining the stoker-fired boiler. Company engineers also considered pulverized-coal firing all three units and pulverized-coal or oil firing all three.

Even though all of these plans could be justified economically and would provide sufficient capacity for present needs, they would not give a satisfactory operating arrangement because of space limitation. Furthermore, a high stack would be required to insure against complaints of flyash nuisance, as the plant is in a thickly populated district, and a new coal-handling system was practically necessary, the same as for a new plant. Because of low-pressure steam limitations, 100 lb, power could not be generated in the future as a byproduct of process steam.

Another problem had to be considered: disposal of scrap linoleum from the manufacturing process. It had been burned in the old hand-fired-boiler furnaces, but the linoleum not only reduced boiler capacity by blanketing the fire but also materially reduced combustion efficiency. Any of the plans mentioned thus far left disposal of the scrap unsolved. It was therefore decided to consider a new high-pressure boiler and power-generating plant with a separate destructor unit for refuse, and retain the old stoker-fired boiler as reserve.

Two studies along this line were made: one included power generation and the other solely a high-pressure boiler plant. The latter plan was accepted. It was found that over 75% of the total saving that could be obtained if a power-generating plant were installed, could be gotten from a new boiler plant alone, with an investment less than 60% of that required for the power-generation plan.

High Cost of Generation

High cost of the generating plant was due to several causes. Building space was available for new boilers, but a new building would have had to have been provided for generating equipment. An extensive underground cable system would be required to tie the generating plant into the distribution system. By not generating power, all steam piping could be installed for 110 lb pressure saturated; cost for reducing valves and a desuperheater to tie the 450-lb superheated steam lines into the 110-lb system could be saved. Old feed pumps and feedwater heater could be used for the new boilers, but if power were generated, new deaerating heater and high-pressure feed pumps would be required.

Steam requirements in the manufacturing processes are large (a maximum of 100,000 lb per hr), whereas purchased-power requirements and the cost in proportion are comparatively small. So much so, that even if generation would cut power cost in half, the saving would be small compared to that obtained from the boiler plant alone.

Space for the new boiler plant was available in an old building adjacent to the stoker-fired boiler. Raising part of the roof of this building and taking out a dividing wall permitted installing the new boilers adjacent to the old unit, thus putting all steam-generating capacity in a single plant at small building cost.

Contract for building the new plant was awarded to the Beaver Construction Co, April 15, 1937. The contract specified that this company was to design, deliver, construct and put into service an underfeed-stoker-fired boiler plant that would operate at 83% or higher over-all boiler and furnace efficiency, which was 15 to 20% better than the old plants. The contract also called for tieing in the old-stoker-fired boiler with the new ones and building a destructor plant for burning linoleum scrap. The limited space available in which to install the boilers resulted in unusual design features in order to get required capacity and obtain a convenient operating arrangement.

Two boilers without superheaters were selected, each rated at 40,000 lb of steam per hour continuous and 50,000 lb maximum for 4 hr. They are designed for 450 lb working pressure but will operate at 110 lb gage. The design pressure permits generating at some future date all power required for the manufacturing plant by turbines exhausting at 110 lb backpressure to process.

The 3-drum, bent-tube boilers are baffled for three passes and have completely water-cooled furnaces and stokers. Boilers and furnace waterwalls have been designed without a single external circulating tube. Lower ends of the front row of boiler tubes are protected by an armor of non-clinkering blocks where they come in contact with the fire at the rear of the stoker. Baffling is arranged to provide a dead air space back of the armor blocks to prevent hot gas filtering through and burning them.

Combustion

Combustion gas discharges near floor level through a cinder catcher made of two rows of angle irons, staggered as shown in Fig. 4. This removes coarser cinders from the gas before it goes to the tubular air heater. Combustion air and draft are supplied by forced- and induced-draft fans and an 85-ft stack. Induced-draft fans, at the boiler tops, take the gas directly from the air heater and discharge into the stack breeching. Forced-draft fans are on the boiler-room floor back of the boilers and discharge into the top of the air heaters. Because of the limited space in which to place the boilers, finding a place for the preheated-air ducts proved to be quite a problem. This was solved by placing them under the boilers, running the full width of each boiler. The tops of the ducts are made of steel plate supported to provide a thin air duct between them and the concrete basement floor and wall, to keep these parts cool. Bottoms of the ducts are made of reinforced concrete.

The foundation directly under the stoker has a covering of heat insulation to prevent heat radiation from the high-temperature air. High temperature of the ducts might dry out the soil and decrease its bearing qualities or the high temperature might generate steam under the ducts and cause an upward lift. Both of these possibilities have been provided for in the design. The concrete foundation footings have been very heavily reinforced and ventilation has been provided for any steam that might form from soil moisture under the ducts.

Operating conditions with the old boilers were such that premium coal had to be used. When selecting firing equipment for the new boilers, a study was made of all coals that might be economically burned in the Philadelphia area, then a stoker design was selected that would efficiently handle any of these coals. This permits the company to purchase the most economical coal, which is a considerable factor in the saving being made by the new plant.

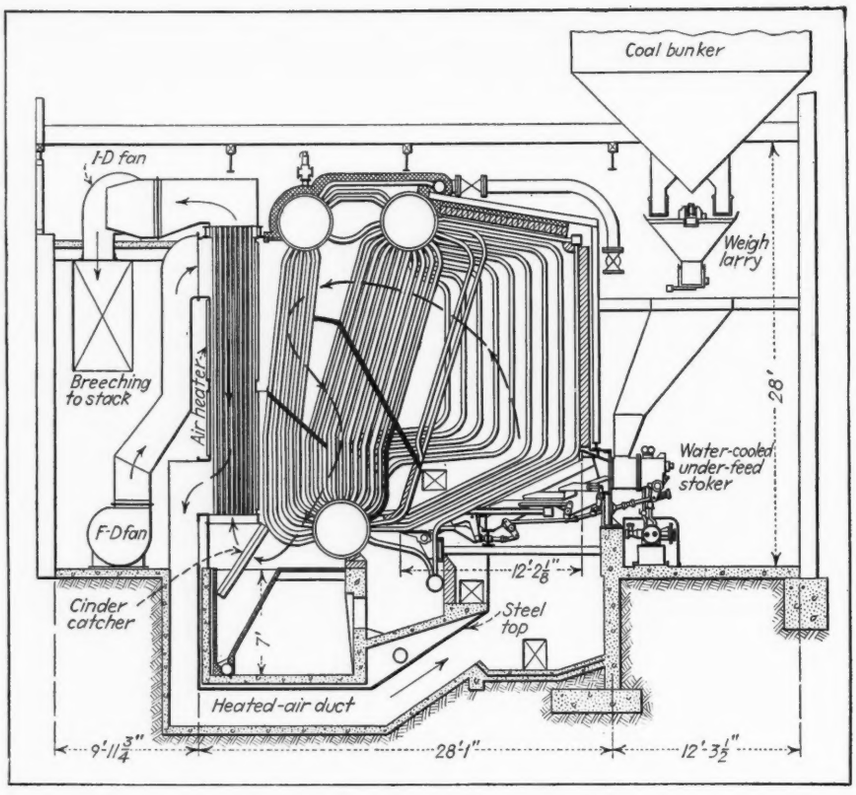


Fig. 4—To simplify plant layout and provide good operating conditions, preheated-air ducts are run under the boilers

The stokers selected are multiple-retort, underfeed, hydraulic-ram design, each ram being driven by oil under pressure. Fluid power for the rams is supplied by Hele-Shaw variable-displacement pumps, one for each stoker, driven by constant-speed motors. Because of the wide range of practical operation with hydraulic rams, coal feed can be varied over limits of 25 to 1. This means that stoker speed can be adjusted to feed coal continuously, for steam demands between 2,000 and 50,000 lb per hr per boiler.

Set in a furnace of 950 cu ft volume, the stokers, 4 retorts wide, 25 tuyeres long, water cooled, have 86 sq ft projected grate area. Ashes discharge continuously from the stokers, but the rate of discharge is adjustable while the stokers are operating. Soot from the bottom of the stack and around the boilers is removed by a steam-jet conveyor and discharged into one of the stoker ash hoppers. Ashes are removed from the hoppers by hand into wheel barrows and conveyed a short distance to an existing skip hoist between the old stoker-fired boiler and the new units. The hoist discharges into an elevated ash tank which dumps into motor trucks for removal from the plant.

New Coal-Handling System

Space was available for a coal-storage yard adjacent to the new plant, which provided a solution to the coal-handling problem. Coal is now brought by rail alongside this yard and dumped into a track hopper. An apron feeder discharges into a bucket elevator that delivers to an elevated hopper with two spouts. One spout leads to a belt conveyor going to a 100-ton circular coal bunker above the boiler plant firing aisle, Fig. 3. The other spout leads to the coal yard, with a possible storage of 1500 tons. In the yard, coal is stored or recovered with a drag scraper. When the bunker is full, the coal-handling system is shut down automatically. Then, by throwing a gate, coal can be directed down the spout leading to the storage yard and the system started again.

From the bunker, coal is weighed into the stoker hoppers by a larry. Coal gates and larry controls are at the coal scale at one end of the combustion-control and meter panel, Fig. 2. Larry tracks have been extended over in front of the older standby boiler so that it can also be served from the coal bunker.

On the meter panel are the master regulator, fuel, air and furnace-pressure controls for automatically controlling combustion of the boilers together or as single units. The fuel regulator acts on the variable-displacement pumps on the stoker drives. Induced-draft regulation is by a combination of fan-turbine speed and damper control under direction of air regulator.

Forced draft-fans are driven by 2-speed (1200- and 1800-rpm) motors. Normally the motors operate at 1200 rpm and forced draft is regulated by automatic damper control from the furnace-pressure regulator. During peak loads, which occur infrequently, when furnace pressure cannot be maintained with the forced-draft fans operating at 1200 rpm, the motors are switched manually for 1800-rpm operation.

Meters on the meter panel include a 6-point draft gage for each boiler; a 4-point recording potentiometer on each boiler, each point connected to three thermocouples, to obtain average air and gas temperatures into and out of the air heater; a graphic meter to record steam pressure, feedwater pressure and temperature; a steam flowmeter, CO_2 recorder and a pressure gage for each boiler. Lights on this panel show high- and low-coal levels in the bunker and high- and low-water levels in the hotwell. The meter and control panel, coal scale and coal-larry control are all located so that the operator has complete control of both boilers from a single location and can operate under practical test conditions.

Makeup, which represents about 30% of the boiler feedwater, comes from city mains and is treated in a zeolite softener, from where it flows through the heat exchanger in the continuous-blowdown system into the makeup-feed-pump suction line from the hotwell. Thus, total makeup is pumped directly to feedwater heater.

Feedwater Heating

Feedwater is heated in an open-type heater, already installed in the old boiler-plant pump room; on which 5 lb backpressure is maintained by the exhaust steam from the induced-draft-fan turbines and the boiler-makeup and feedwater pumps. This heater is equipped with a V-notch meter that records total feedwater flow. Feedwater going to the boiler on the scrap-destructor furnace is also metered.

The contract under which the plant was built called for an ASME-Code test of the boilers. However, when the plant was completed and ready for testing, the owners felt that, in view of the completeness of the instruments and controls which were then just recently checked and calibrated, they would govern their acceptance or rejection of the plant on the basis of a one month's test of actual operating results obtained while running both boilers under automatic control.

During this test the two boilers produced 29,197,000 lb of steam, burned 2,395,000 lb of coal at an average boiler and furnace efficiency of 86.5% for one unit and 86.7% for the other. During the month each boiler was operated for periods at 10,000 lb of steam per hr and for others at 40,000 lb to test the automatic combustion control, and to observe the boiler's steaming ability and general operating characteristics from low to high ratings. Under all conditions of load the boilers, stokers and automatic control exceeded expectations.

Coal burned during this test was slack of $\frac{3}{4}$-in. maximum size with a heating value of 14,162 Btu and an ash-fusing temperature of 2200 F. Meters were checked before and after the test and 1% was deducted from the flowmeter readings to allow for possible inaccuracies. Accuracy of these tests is not only attested to by the check made on the meters, before and after the tests, but each boiler produced practically equal amounts of steam and burned nearly equal quantities of coal. This would indicate that flowmeter readings are accurate.

The plant has more than met performance expectations of the company's engineers. Reduction in operating cost will repay the investment in the new plant in about three to four years. These savings result chiefly from a reduction in labor costs, an improvement of from 15 to 20% in efficiency and burning a low-priced coal.

During construction and testing of the plant, Sloane-Blabon Corp was represented by its plant engineer, R R Frederick, to whom *Power* editors extend their thanks for assistance in preparation of this article.

Principal Equipment in New Boiler Plant

SLOANE-BLABON CORP, PHILADELPHIA, PA.

General contractor ..... Beaver Construction Co
Boilers with waterwalls, 2 ..... Edge Moor Iron Co
Boiler heating surface, 3880 sq ft; waterwall surface (without stoker cooling), 509 sq ft; stoker waterscreen, 68 sq ft; max. continuous steaming capacity 40,000 lb per hr; max. steam capacity for 4 hr, 50,000 lb per hr; designed working steam pressure, 450 lb; designed working steam temperature, 700 F; present operating pressure and temperature, 110 lb. per sq in. saturated. Furnace volume, 950 cu ft; normal Btu liberation per hr per cu ft of furnace volume 50,000; max. Btu liberation per cu ft, 65,000.
Air heater, tubular, 3926 sq ft ..... Edge Moor Iron Co
max. air temperature, 375 F
Soot blowers ..... Vulcan Soot Blower Corp
Water columns ..... Reliance Gauge Column Co
Boiler settings, 7.5 in. tile ..... DeWolf Furnace Corp
Boiler settings installed by ..... Hamilton Construction Co
Furnace and air heater, heat insulation ..... Quigley Co, Inc
Heat insulation installed by ..... Hamilton Construction Corp
Waterwalls at stoker dump plate ..... Drake Non-Clinkering Furnace Block Co
armor-clad with cast on blocks.
One, 150x7-ft steel stack dismantled at old boiler plant and 72 ft re-erected to serve the new boilers ..... A B Van Duser

Combustion Equipment:

Automatic combustion control ..... Hays Corp
Stokers, 2 ..... American Engineering Co
Type, Taylor underfeed, watercooled for max. air temp of 375 F; 4 retort, projected grate area, 86 sq ft; lb of coal per hr, per sq ft of grate, max. 52.5, continuous, 40
Stoker drive; hydraulic rams operated by variable-displacement Hele-Shaw pumps ..... American Engineering Co
Hele-Shaw pumps driven by 7.5-hp squirrel-cage motors ..... Crocker-Wheeler Elec Mfg Co
Forced-draft fans, 15,500 and 8,700 cfm at 70 deg F and 7.5 and 4.0 in static pressure; speed 1780 and 1170 rpm ..... B F Sturtevant Co
Forced-draft fan drives, 2-speed, 25- and 11-hp motors ..... Crocker-Wheeler Elec Mfg Co
Induced-draft fans, two 31,500 cfm at 445 F and 5 in. static pressure at 1580 rpm ..... B F Sturtevant Co
Induced-draft-fan drives, 45-hp turbines designed for 110-lb saturated steam and 5-lb backpressure ..... B F Sturtevant Co

Coal- and Ash-Handling Equipment:

Coal-handling equipment: track hopper, feeder conveyor, bucket elevator, belt conveyor and 100-ton elevated silo ..... Beaumont-Birch Co
Drag scraper in storage yard ..... Beaumont-Birch Co
Weigh larry, motor operated ..... Beaumont-Birch Co
Weigh-larry scale ..... Buffalo Scale Co
Doors on ash pits ..... Connery Construction Co / United Conveyor Corp
Soot-handling equipment, steam-jet ..... United Conveyor Corp
Ducts and breechings ..... Connery Construction Co

Feedwater Equipment:

Zeolite softening system ..... Cochrane Corp
Continuous blowdown system ..... Cochrane Corp
Feedwater regulators, Copes ..... Northern Equipment Co

Valves, Piping and Traps:

Blowdown valves ..... Yarnall-Waring Co
Safety valves ..... Consolidated Ashcroft-Hancock Div
Non-return valves ..... Elliott Co
Feedwater valves ..... Jenkins Bros
High- and low-pressure valves ..... Jenkins Bros
Piping, Wheeling ..... McArdle & Cooney, Inc
Expansion bends, Wheeling ..... McArdle & Cooney, Inc
Pipe heat insulation ..... Ehret Magnesia Co
Traps ..... Armstrong Machine Works
Piping contractors ..... Charles A Jerol / George F Nelson

Meters:

Meter and control board ..... Hays Corp
Steam flowmeters ..... Cochrane Corp
Draft gages, 6 point ..... Hays Corp
Pressure gages, indicating ..... Crosby Steam Gage & Valve Co
Recording potentiometers, 4 point ..... Brown Instrument Co
CO_2 recorders ..... Hays Corp
Pressuure and temperature recorders ..... Cochrane Corp
Makeup feedwater flowmeter ..... Trident Meter Co

Refuse destructor:

Installed by ..... Morse Boulger Co
Boiler, heating surf., 660 sq ft; operating pres. 110 lb g ..... E Keeler Co
Steel stack and breeching ..... Connery Construction Co

Water-Wise Refrigeration

Don't waste water to save power—don't waste power to save water. Here's the way to balance costs and save refrigeration dollars

By W H MARTIN and R E SUMMERS
Dept of M E, Oregon State College

PRINCIPAL operating costs in a refrigerating plant, aside from labor, are those for energy and water. Attempts to economize on cooling water are liable to result in excessive energy consumption; reduction of energy use to a minimum can cause excessive water costs. Some one combination is best—how can it be found? Here is the way it was done in an actual case. Because conditions vary from plant to plant, the figures have little general value, but the method, with small changes, can be applied in most plants. To grasp the how and why of it, let's trace, step-by-step, the procedure followed.

In the plant surveyed, a 7x7-in., 2-cyl, vertical, single-acting compressor is electrically driven and the ammonia condenser is cooled with water from a deepwell. Average temperature is 56 F; there is no cooling tower. Occasional high head pressures (up to 160 lb g) suggest that a more economical operating condition might be established. First step is to determine the electrical consumption of the deepwell pump; energy cost for water is found to be 1.75 cents per 1000 gal. Next, tests on the induction motor driving the compressor, at several head pressures, reveal an over-all efficiency, or ratio of adiabatic horsepower to electrical input, of close to 50%.

Before these data can be put to work, certain assumptions have to be made: (1) that vapor enters the compressor dry saturated, (2) that motor efficiency is 0.86, (3) that temperature of water leaving the condenser is 3 F below condensing temperature of the refrigerant, and (4) that condensing temperature corresponds to discharge pressure.

With these assumptions made, it is possible to start calculation by determining the adiabatic horsepower per ton of refrigeration. A refrigerating cycle for 20-lb g suction pressure and 140-lb g discharge pressure is shown in Fig. 1. Heat absorbed is equal to heat content at "c" (613.5 Btu per lb) minus heat content at "a" (132.7) or 480.8 Btu per lb. Adiabatic work necessary to compress 1 lb of ammonia is equal to heat content at "b" (705.4) minus heat content at "c" or 91.0 Btu. Since a ton of refrigeration is 12,000 Btu per hr, the weight of ammonia that must be circulated is 12,000 ÷ 480.8 or 24.96 lb per hr. The adiabatic work per ton-hr is 24.96 × 91.9 or 2292 Btu. Dividing by 2545 Btu per hp hr gives 0.902, the adiabatic horsepower. Dividing the adiabatic horsepower by 0.50, and multiplying the answer by 0.746 gives the electrical input in kilowatts.

Energy Computations

For each of several suction pressures a series of these computations is made, at different head pressures. Plotting kilowatt-hours per ton-hour of refrigeration against head pressure produces Fig. 2. It can be seen that for each suction pressure, the relation between discharge pressure and energy consumption of the motor is substantially a straight line. Also, lines for different suction pressures are practically parallel. Knowing suction pressure and discharge pressure, in any given case, it is easy to find energy consumption. This chart can be used for any compressor if allowance is made

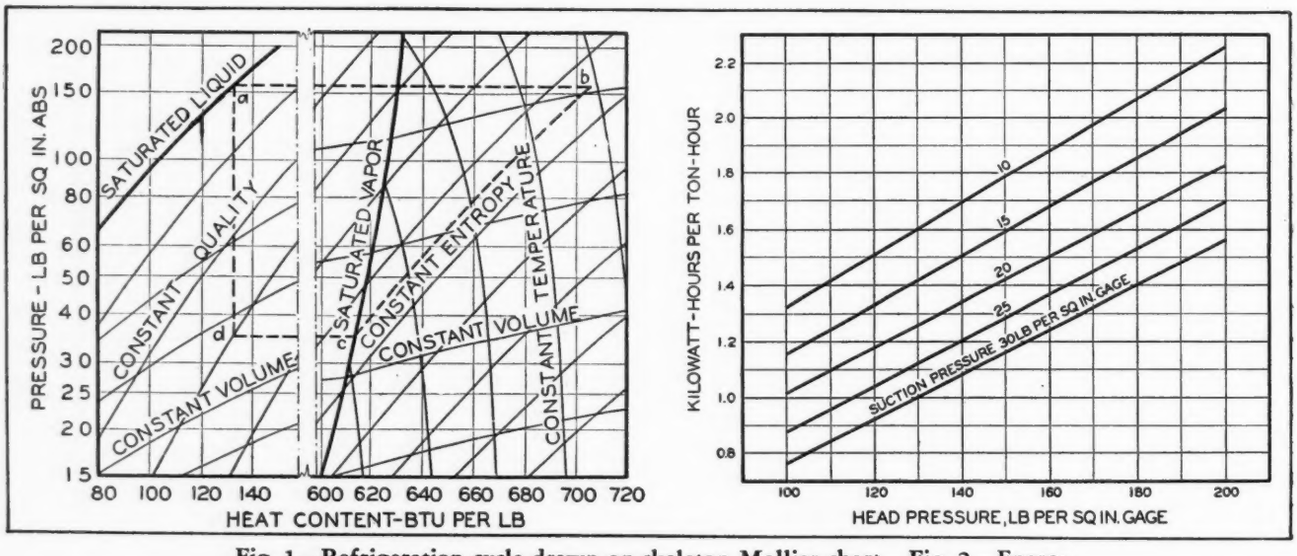


Fig. 1—Refrigeration cycle drawn on skeleton Mollier chart. Fig. 2—Energy consumption of ammonia compressor, under various operating conditions

for variation in over-all efficiency, Multiply values taken from the chart by 0.50 ÷ E where "E" is over-all efficiency of the given compressor expressed as a decimal.

So much for the energy consumption of the compressor. Next job is to estimate the heat to be removed by the condenser and jacket water. Total heat to be removed by water cooling equals heat absorbed in evaporator, plus work done on the refrigerant vapor, plus friction losses to the cylinders. On a ton-hour basis, heat absorbed in the evaporator is 12,000 Btu. With over-all efficiency equal to 50%, the work done on the vapor is half the energy consumption per ton-hour, as shown by Fig. 2, for any set of suction and head pressures.

Friction Losses

Figuring the friction losses takes a little longer but is relatively simple. Based on the assumed motor efficiency, 0.86 of each kw gets to the compressor shaft, and since half of each motor kw appears as useful work on the vapor, the work lost in friction is 0.36 of the input, by difference. Of this amount about half is crankshaft friction, little or none of which finds its way to the cylinder-jacket water. Thus friction heat to be removed by cooling water amounts to 0.18 of the electrical input.

An example will show how this analysis fits an actual case. Assume 20-lb suction pressure and 140-lb discharge pressure. From Fig. 2, the kilowatt-hours per ton-hour is 1.345 which amounts to 4589 Btu per ton-hour (multiplying by 3412 Btu per kwhr). Half of this is useful work, and 0.18 goes to friction, making a total of 0.68 x 4589 or 3120 Btu per ton-hour. Adding 12,000 Btu absorbed in the evaporator, we get a total of 15,120 Btu per ton-hour to be removed by cooling water. Since heat absorbed in the evaporator is the major portion of this, it is evident that over-all efficiency can vary considerably without greatly affecting the total amount of heat to be rejected.

To remove 15,120 Btu per ton-hour, how much water is required? At 140 lb head pressure, the condensing temperature of pure ammonia vapor is 80.6 F, so with a 3 F terminal difference (assumed), cooling-water temperature will be 77.6 F. If 56 F is the entering temperature of cooling water, a 21.6 F rise will result and 15,120 ÷ 21.6 or 700 lb of water will be needed. This is 84 gal.

By repeating this calculation for different suction and discharge pressures, data for a second chart are obtained. Proper choice of coordinates will make these values fall on straight lines. In Fig. 3, the horizontal values are discharge pressures, while the reciprocal of gal. per ton-hour is plotted vertically. In this case, values are shown for inlet-water temperatures of 56, 66 and 76 F, and for each temperature there are curves for two suction pressures, 10 and 30 lb. Values for other water temperatures and suction pressures can be found by interpolation.

It is interesting to note that the water-consumption lines in Fig. 3 for a given suction pressure, are essentially parallel and evenly spaced. Also, when all lines for a particular water temperature are extended, they intersect at the zero line. This is the minimum discharge pressure for the assumed 3 F terminal difference between water and condensing refrigerant. Since there could be no temperature rise, water consumption is infinite.

Now we're getting to the point where it will be possible to forecast the most economical operating condition for the plant. Using the previously mentioned costs of 1.45 cents per kwhr and 1.75 cents per 1000 gal. of water, let's start construction of the last chart needed. As we have seen, for 20-lb suction pressure, 140 lb head pressure, and 56-F inlet water temperature, the energy consumption is 1.345 kwhr per ton-hr, and the water consumption is 84 gal. per ton-hr. Costs for this condition will be: 1.345 x 1.45 = 1.950 cents per ton-hr for energy; 84 x 1.75 ÷ 1000 = 0.147 cents per ton-hr for water. Total cost of operation at this condition is 2.097 cents per ton-hr.

Combined Cost

In Fig. 4, the combined cost for various discharge pressures are plotted, for the three water temperatures of 56, 66 and 76 F, based on a suction pressure of 20 lb gage. With 56-F water, the low point of the combined-cost curve is at a discharge pressure of about 120 lb. This, then, is the most economical point at which to operate.

The curves in Fig. 4 were extended to the left until the temperature rise in the cooling water was only 2 F, which means, of course, large water flows. The effect can readily be seen; the combined cost of water and energy is much higher than when less water is used. That the curves are steep on the left and rather flat at the right indicates that close approach to the theoretical minimum discharge pressure should be avoided.

Here, then, is a method, not too difficult, of balancing energy and water costs, which can be applied to most plants. Many factors, such as motor efficiency, were assumed or estimated, but where facilities are available, and time permits, test data in place of estimated figures will improve results.

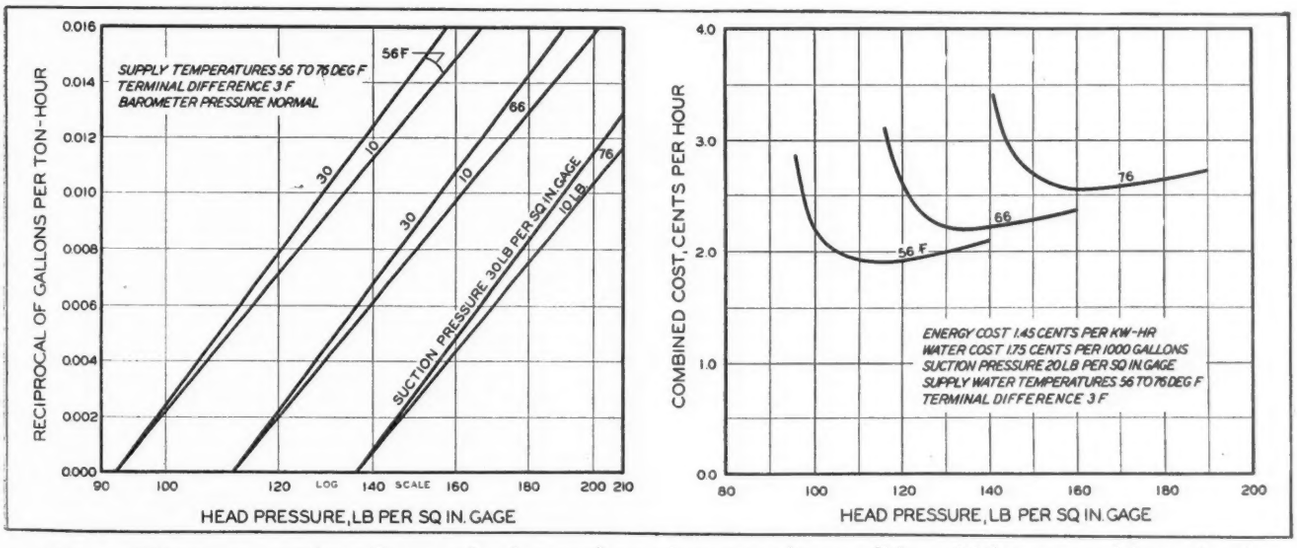
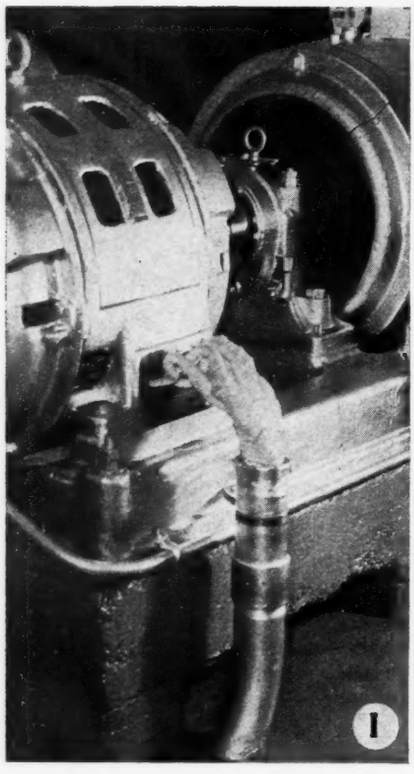


Fig. 3—Water consumption of ammonia plant under various operating conditions (rights reserved by authors).
Fig. 4—Combined energy-water cost for ammonia plant, at various head pressures and water temperatures



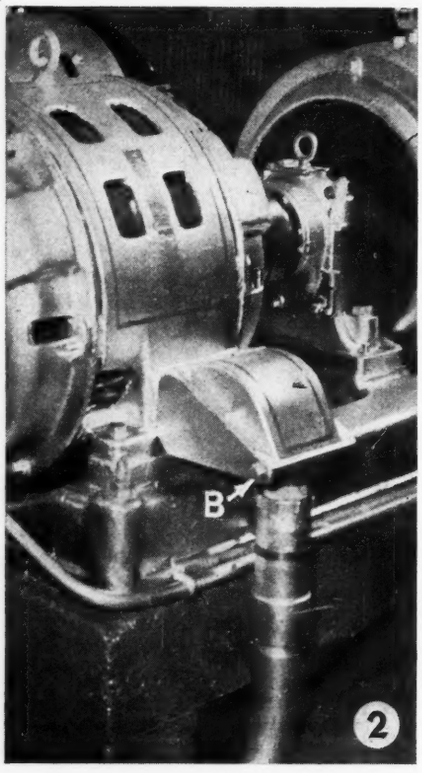


Fig. 1—All motor leads were remade, insulated and covered with asbestos tape. Fig. 2—Motor terminal boxes were cut in half and held together with a through bolt *B*

Tracking Down the Small Defects

It's the little things that count in speeding up elevator service. An engineer describes a case history

By WILLIAM DEVAUGHN
Elevator Engineer, Bank of Manhattan Bldg

QUALITY of elevator service is frequently determined at the hoistway landings. If the cars come to the floors, stop smoothly and land accurately, and if the hoistway doors respond quickly, the service may be good. When these conditions do not exist, the lost time at the landing may be sufficient to make the elevator service unsatisfactory.

We work on this theory in the Bank of Manhattan Company Building, 40 Wall St, New York, N. Y., and have given a great deal of attention to the things that affect the leveling in of the cars at the floor and to car- and hoistway-door operation. We were having considerable trouble in getting consistent car performance when leveling into the floors. Also, door operation was sluggish. As a result, operators had difficulty in maintaining schedules and elevator service was not up to the high standards we wish to maintain.

The double-wrap, automatic-leveling elevator machines have unit multi-voltage control. A test of the exciters and generators revealed a voltage drop of 10 to 12 volts across the brushes and commutators. We also experienced trouble with sparking at the brushes that made it difficult to keep the commutators clean. This difficulty was cleared up by using a semi-hard brush; installing new brush-holders that permitted very close adjustment of the holder position relative to the commutator and of the brush angle; and by conditioning the commutator surfaces by grinding. This eliminated the trouble at the brushes and commutators of exciters and generators and improved operation, but left room for further improvement.

General Overhaul

We then overhauled the floor selectors, renewed all worn parts so as to practically eliminate all lost motion. Part of this was accomplished by replacing all solid bushings on the square steel guide rods with new bronze ones having a spring and bolt adjustable feature that permits operating with close clearances. We also completely overhauled operating equipment on all doors and put it in first-class condition. This gave us the desired door performance and improved leveling into floors, but at times the latter was not as consistent as we wanted. A burnout in the terminal box on one of the motor-generator motors led us to suspect that some of the connections were faulty. Rather than trying to find the faulty ones, we remade all connections on the motor generators.

Insulation on motor leads showed signs of deterioration. This was remedied by disconnecting one motor at a time, taking off the terminal box so that the leads could be easily worked on. We then inspected the soldering of all lugs on leads coming from the motor and from the control panel. Any that looked at all suspicious were unsoldered and, after the lug socket and terminal had been thoroughly tinned, the connection was resoldered. Then, all contacting surfaces between lugs were thoroughly cleaned and the lugs connected together with brass bolts, that would just fill the holes, and a 1-in. brass washer $\frac{1}{8}$-in. thick put under the nut and bolt head. After remaking and insulating the connections, we covered each lead with asbestos tape from the end of the conduit into the motor, Fig. 1.

In replacing terminal boxes, they were cut with a hacksaw through the center and bored for a horizontal through bolt *B* near their outer edge, Fig. 2. This permitted placing the box around the leads and conduit, attaching it to the machine frame and tightening it around the conduit with the through bolt. The boxes are now just as rigid as when they were in one piece. Now, whenever it is necessary to get at the motor leads, the boxes are easily removed to give free access for inspection, maintenance and repair work.

To complete the job on the motor generators, all bolted connections on the exciters and generators were opened, cleaned and remade. These included connections to brush-holder studs, to machine terminals, between field coils, etc. Where iron bolts had been used, they were replaced with brass ones with heavy brass washers under the bolt heads and nuts. While doing this work, we discovered several defective connections that had given no outside evidence of anything wrong.

These changes have greatly improved elevator operation, which is proof that a lot of little defects that give no evidence of their existence may be very annoying. Leveling control can be adjusted to bring the cars quickly, smoothly and accurately into the floors and to do this consistently day after day. Elevator service has been brought to a high standard and operating schedules are easily maintained.

✦ ✦ ✦

Questions for Boiler-Room Engineers

By Harry M Spring

THESE QUESTIONS are similar to those asked in some of the better-arranged state examinations for licenses to operate steam boilers. Use them as an aid in interviewing and selecting power-plant employees, and as a review of important features of boiler-room operating practice. From time to time *Power* will publish additional questions of this type.

Q—What would you do if a blowdown pipe failed under pressure?

A—Get rid of the fire at once. Feed all water possible to the boiler, taking care not to rob other boilers in the battery, however. Continue this procedure until boiler and setting have cooled. The stop valve to the steam main should be closed at once if there is any other boiler operating in battery.

Q—What would you do if a boiler tube failed under pressure?

A—Follow procedure outlined in the preceding answer.

Q—What is the difference between a bag and a blister?

A—A bag is a bulge in a boiler shell or tube, affecting the entire thickness of the plate. It is caused by overheating. A blister is a bulged section on the plate or tube, affecting a fraction of the thickness exposed to the fire. It is caused by laminated material.

Q—Will oil in a boiler do any good?

A—No. It is a heat insulator and extremely dangerous.

Q—How near to header pressure should boiler pressure be before putting a unit on the line?

A—About equal, preferably several pounds under.

Q—Is there any difference between priming and foaming? What dangers are involved?

A—Foaming is caused by high concentration and surface tension of the boiler water. It causes a multitude of bubbles on the surface, making the correct water level difficult to detect. Solids may be carried over to obstruct lines and damage steam equipment. Frequent blowdown and feeding fresh water will reduce the condition. When priming occurs, a solid body of water is carried over with the steam flow. This is caused by too high a water level, too sudden a demand for steam, or both. It frequently causes water hammer and damage to steam equipment.

Q—Where can faulty brickwork be dangerous with a horizontal-tubular boiler?

A—Under the dry sheet and front tube-sheet seam in a flush-front boiler. Failure of the rear arch or closing-in line allows fire to go above water line and come in contact with suspension brackets and riveted seams.

Q—What is water hammer in a steam line?

A—A pocket of water is carried along with steam flow. In striking an abrupt turn or obstruction, it may cause rupture of a fitting.

Q—What causes steam binding and air binding in a boiler-feed pump? How is it prevented?

A—Steam binding is caused by too high a feedwater temperature with too low a head to the feedpump suction. Reducing the temperature or increasing the suction head will correct the condition. Air binding is found in pumps having a negative suction lift. It is caused by air leaks in packing glands or fittings in the suction system. Stopping these leaks will prevent it.

Q—What causes smoke?

A—Incomplete combustion is the direct cause. Improper firing rate, wrong type of fuel for furnace, or improper air supply are contributing factors.

Q—If a boiler safety valve is set at 175 lb and you wish to reset it at 225 lb, what do you do?

A—Get the advice of an authorized boiler inspector as to whether the boiler is safe for the higher pressure, and that it conforms to local boiler laws. A new safety valve spring is required for a change of over 10% of the rated pressure.

Q—What is the blowback of a safety valve? How is it adjusted?

A—Blowback is the number of pounds pressure drop from the point at which the valve pops, to the pressure at which it seats. It should be about 4% of the popping pressure but not less than 2 lb. It is adjusted by the position of the blowback ring, or the "VO" plug in another type of valve. The adjustment varies the total pressure on the main valve when it is slightly off its seat.

Q—What would you do if you saw steam leaking from a boiler in the vicinity of a riveted seam?

A—Shut the boiler down immediately, and have it inspected. It may be cracked and in a dangerous condition.

Q—Boiler safety valves are set to blow at 200 lb and they blow when the gage reads 125 lb. What is the trouble and what would you do?

A—Assume the safety valve is correct and check the pressure gage at more than one location. Another accurate gage might be attached to the same gage line and show 125 lb also, due to an obstruction in the pipe. The gage line should be blown to check for such an obstruction. If not free, the line should be taken down and cleared or renewed. A faulty safety valve can cause the trouble, but it is usually the steam gage or piping.

Q—Under what conditions would you want a stop valve in the safety-valve connection?

A—Under no conditions.

Q—Is it good practice to feed water in the blowoff?

A—No. It enters an area of sluggish circulation. Oxygen does not pass into the steam space as quickly as in other methods and corrosion is accelerated.

Speaking of Power

Many of *Power's* readers are interested in labor problems from one angle or another. Here is a bit of practical information which may come in handy some day when the local management makes a written agreement with labor, or when some dispute arises between them after an agreement has been made. The American Arbitration Association (8 West 40th St, New York) has for some time been appointing tribunals to arbitrate such disputes where both parties so request. Moreover, any labor agreement may contain a clause automatically submitting any future dispute to arbitration under the rules of the Association. If you are interested, you can get further details by writing the office of the Association. . . . I feel free to mention this service here because the AAA is neither a business enterprise nor a propaganda agency. Its sole function is to facilitate arbitration of all kinds of commercial disputes to avoid costly litigation and delay. While there are some fees to cover costs, it is my understanding that the AAA is a non-profit organization and that arbitrators appointed are public spirited citizens who serve without salary.

. . . not a propaganda agency

As far as I know, only two "superheated water" systems have been installed in the United States to date. Both are used for process heating in plastic molding factories. One was described in January, 1938, *Power*. Yet I understand that hundreds of superheated-water systems have been installed in Europe since 1926. Why this contrast in popularity? . . . In case you don't recall *Power's* article, the socalled superheated water is merely water circulated by pump (under pressure, of course) at temperatures above the atmospheric boiling point of 212 F. This water may be used for space heating or for process heat. Traps and drains are avoided. High-temperature permits high rates of heat transfer and also increases the heat-delivering capacity of a given water flow. . . . At best, of course, the available heat in a pound of water (measured above the return temperature) is a small fraction of the latent heat of a pound of steam, but remember that the water is far more dense, so that the heat delivery capacity of a given pipe may be even greater with water than with steam. . . . Many of the European installations are for space heating, rather than for process. Russia, for example, has standardized on hot water for district heating. Frequently this water is considerably "superheated" in cold weather, although well below 212 F in mild weather. In Moscow the temperature of the water delivered to the consumer varies from 160 F, for outside temperatures of 30 F and above, to 270 F for outside temp. of minus 13 F or lower.

. . . water delivered to customer in Moscow

The reader correspondence that flooded this office after publication (March *Power*) of "So You Want to Be an Engineer", set me thinking and observing some more along these lines. "What kind of education and experience makes the best start for an engineering career?" Getting the right answer to that question is mighty important to thousands of mechanically inclined young fellows. . . . After further investigation, I feel more strongly than ever that practical experience before graduation is very important. A fellow ought to start working around in shops and factories, and on construction jobs, almost as young as the child-labor laws will permit. Why emerge from college as a complete tenderfoot when you can just as well "start life" with some of the rough corners already sanded off. . . . Summer experience gives the student the "feel" of tools and machinery, grease and overalls. Above all, it teaches him how to get along with the average Tom, Dick and Harry. This last is a great art. Those who would master it had better start mighty young.

. . . complete tenderfoot

By the way, employers tell me that the young grads who have worked summers move ahead faster and further. . . . Some of the professors may suggest that this experience can safely be deferred until after graduation. Not so, I think. The trouble is that the young graduate too often starts with a job in the drafting room or office, bypassing the plant completely. He then spends the rest of his life laying out and designing jobs without ever having executed any with his own hands. All his life he makes the same practical mistakes over and over again. All his life shop men and practical mechanics give him the horse laugh behind his back and wonder how engineers get that way.

. . . horse laugh behind his back

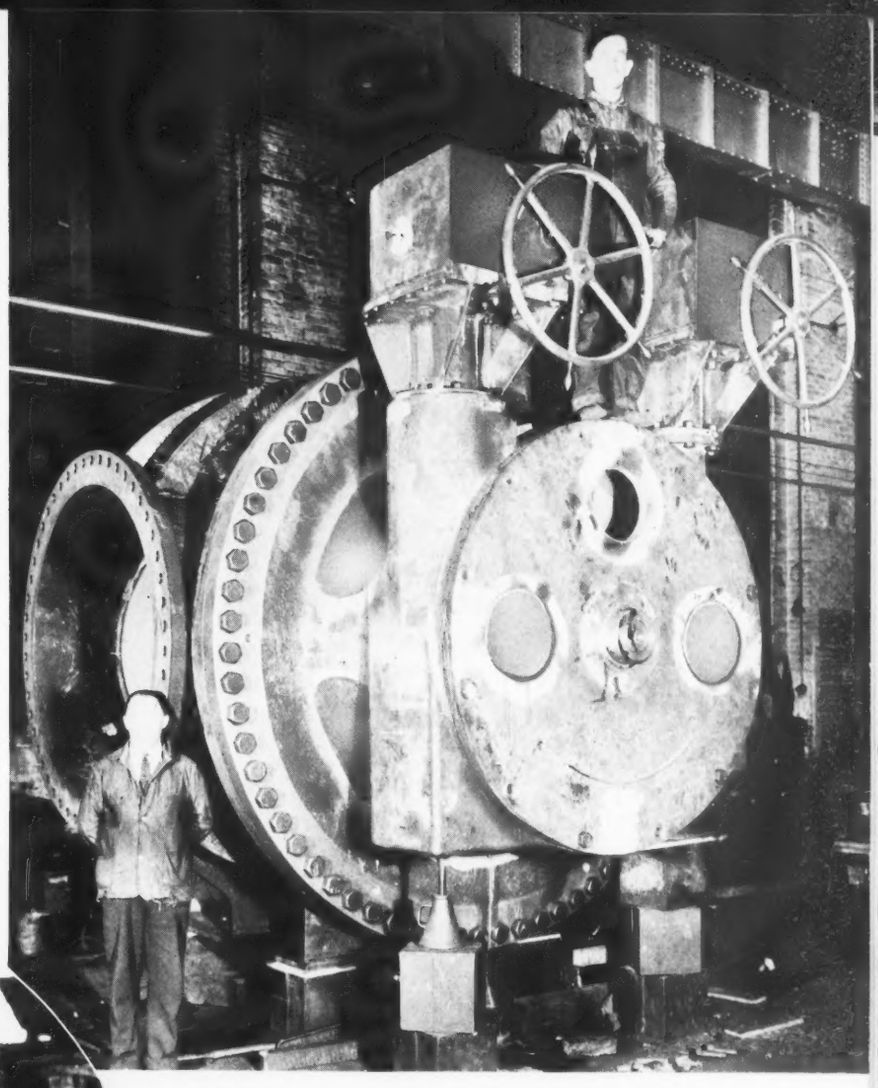
The foregoing has been slanted toward the man who is preparing for life as an engineer by getting a solid theoretical background. To him I say "Don't neglect the practical". To the men who came up the line through the shop or plant without benefit of college, and to those who are headed that way, I say "Don't neglect theory". . . . Sauce for the goose is sauce for the gander. A half engineer is never worth as much as a whole engineer. Neither the "theorist" nor the "practical man" will generally get to the top of the ladder. For the man who is skilled in both theory and practice (including human relations) the sky is the limit.

. . . sky is the limit

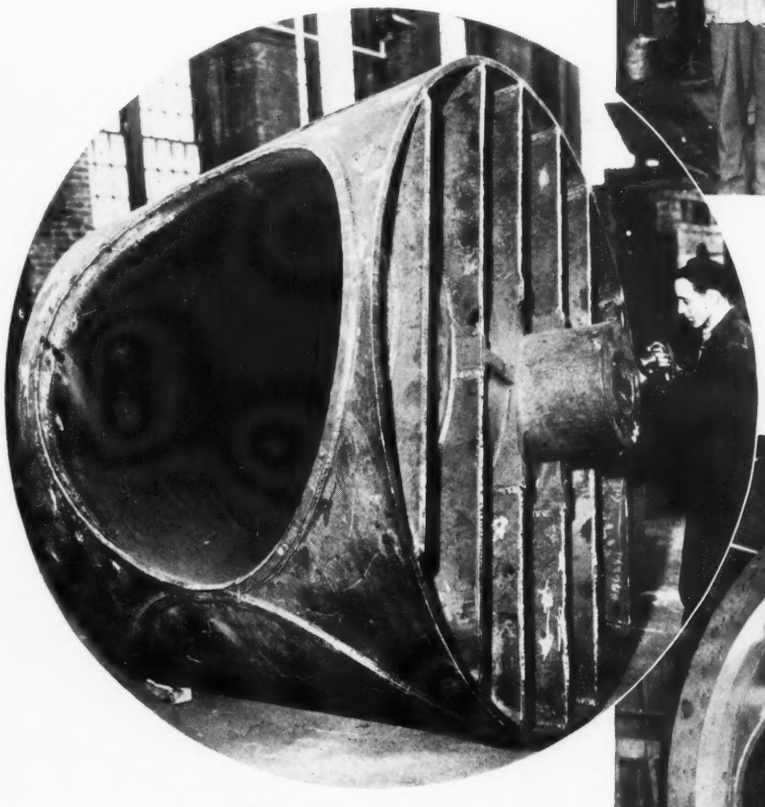
PHIL SWAIN, *Editor*

Cone CONTROL

THIS cone valve, one of the two largest ever made in this country, is on a pipeline that goes through the pioneer bore of the Moffat Tunnel to furnish water for Denver, Col. S Morgan Smith Co, York, Pa., made the valve. It is intended for emergency use.



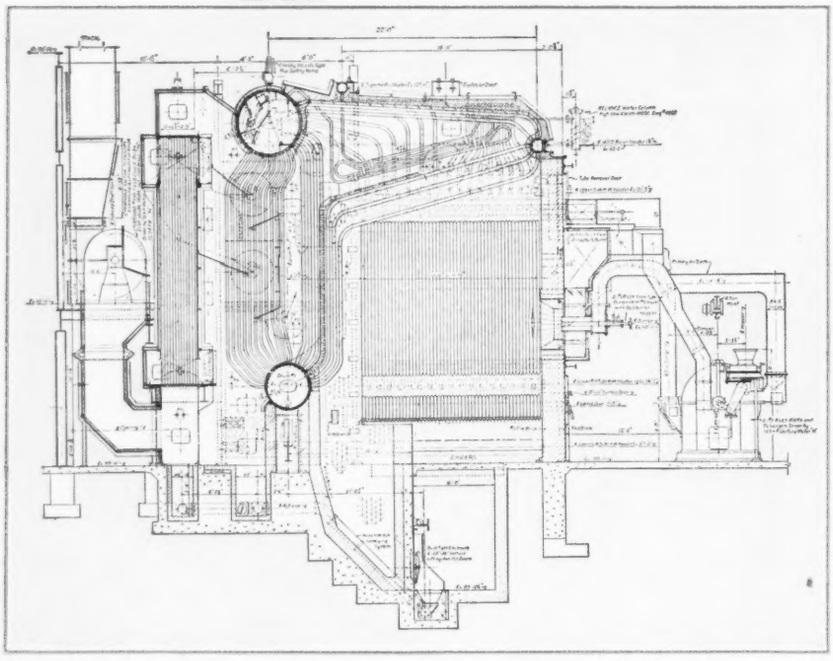
Assembly of Denver's 60-in., manually operated cone valve, which weighs approximately 60,000 lb



Cone for the 60-in. valve is built entirely by welding and has stainless-steel seating rings

A welder at work on the valve casing. Seating rings are stainless-steel strips 2 in. wide and 0.5 in. thick

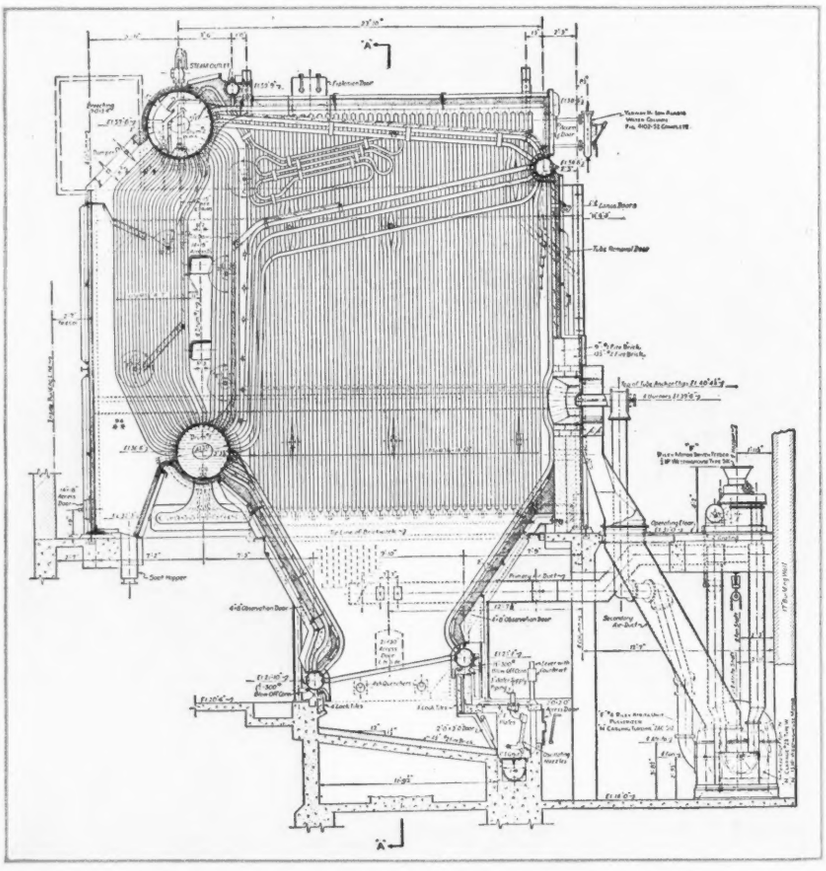
Typical Installations



Things have been happening in the boiler industry. During the past five years, tremendous strides have been made in boiler design. New standards have been established. Modern units give higher efficiencies and greater reliability, at lower investment costs.

Wheeling Steel Corp.
Portsmouth, Ohio
Riley Type "RP"
Steam Generating Unit
Capacity 100,000 lbs./hr.
Efficiency 84.8% at 100,000 lbs./hr.
Pulverized Coal Fired

Bemis Bros. Bag Co.
Peoria, Ill.
Riley Type "RP"
Steam Generating Unit
Capacity 70,000 lbs./hr.
Efficiency 80% at 50,000 lbs./hr.
Pulverized Coal Fired
No Air Heater



A FEW RECENT INSTALLATIONS
RILEY STEAM GENERATING UNITS

Northern Paper Mills, Green Bay, Wis.
Houston Power & Light Co., Houston, Texas
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
City of Columbus, Ohio
Boro of Lansdale, Pa.
Western Cartridge Co., E. Alton, Ill.
Winchester Repeating Arms, New Haven, Conn.
North Dakota Power & Light Co., Bismarck, N. D.
Humble Oil & Refining Co., Baytown, Texas
Newport Electric Co., Newport, R. I.
Publicker Commercial Alcohol Co., Philadelphia, Pa.
Burroughs Adding Machine Co., Detroit, Mich.
Wheeling Steel Corp., Portsmouth, Ohio
Central Illinois Light Co., Peoria, Ill.
MacAndrews & Forbes Co., Camden, N. J.
University of Maryland, College Park, Md.
North Dakota Power & Light Co., Beulah, N. D.
Fort Bend Utilities Co., Sugarland, Texas

TRADE MARK Rx REGISTERED
STEAM FROM CONTINUOUS STOKER FIRED CLEVELAND

RILEY

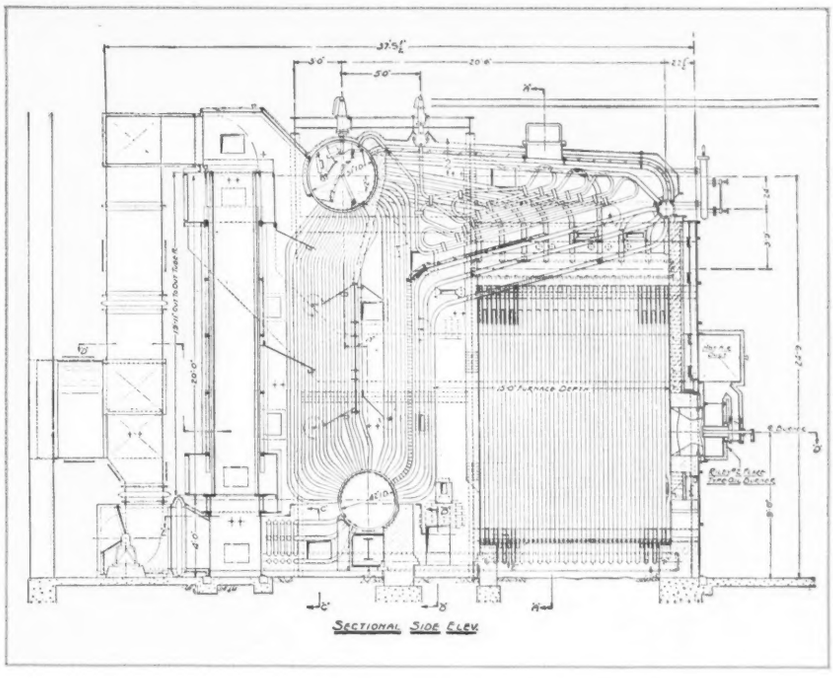
STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Pittsburgh Buffalo Cleveland Detroit Tacoma Baltimore Milwaukee Denver
St. Louis Cincinnati Houston Chicago St. Paul Kansas City Los Angeles Atlanta Memphis New Orleans

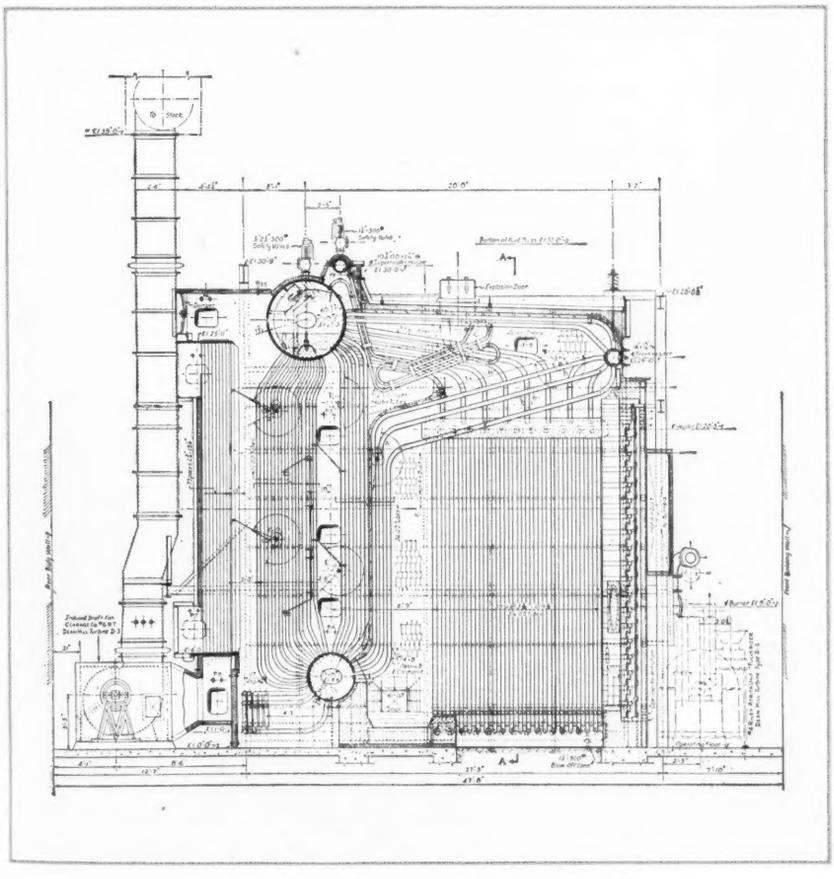
It will pay you to visit modern Riley Installations

# of Modern Boiler Units

A thorough knowledge of present-day design practice and operating characteristics is essential to the intelligent selection of steam generating equipment today. This knowledge can only be obtained by getting out into the firing aisle, by investigating design characteristics and by observing modern units under actual operating conditions.



Newport Electric Corp.
Newport, R. I.
Riley Type "RP"
Steam Generating Unit
Capacity 60,000 lbs./hr.
Efficiency 85% at 60,000 lbs./hr.
Oil Fired



Guide Lamp Company
Anderson, Ind.
Riley Type "RP"
Steam Generating Unit
Capacity 50,000 lbs./hr.
Efficiency 85.8% at 37,500 lbs./hr.
Pulverized Coal Fired

A FEW RECENT INSTALLATIONS
RILEY STEAM GENERATING UNITS

Humble Oil & Refining Co., Ingleside, Texas
City of Detroit Lakes, Minn.
Great Lakes Steel Corp., Detroit, Mich.
Port Huron Sulphite & Paper Co., Port Huron, Mich.
Natrona Power & Light Co., Natrona, Pa.
Otter Tail Power Co., Wahpeton, N. D.
Hartford City Paper Co., Hartford City, Ind.
Celanese Corp. of America, Cumberland, Md.
Hellwig Silk Dyeing Co., Philadelphia, Pa.
Libby Owens Ford Glass Co., Rossford, Ohio
Central Ohio Light & Power Co., Bluffton, Ohio
General Aniline Works, Rensselaer, N. Y.
American Brass Co., Kenosha, Wis.
Godchaux Sugars, Reserve, La.
Moore Steam Turbine Co., Wellsville, N. Y.
Riverside Metal Corp., Riverside, N. J.
W. Va. Pulp & Paper Co., Luke, Md.
W. Va. Pulp & Paper Co., Covington, Va.

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

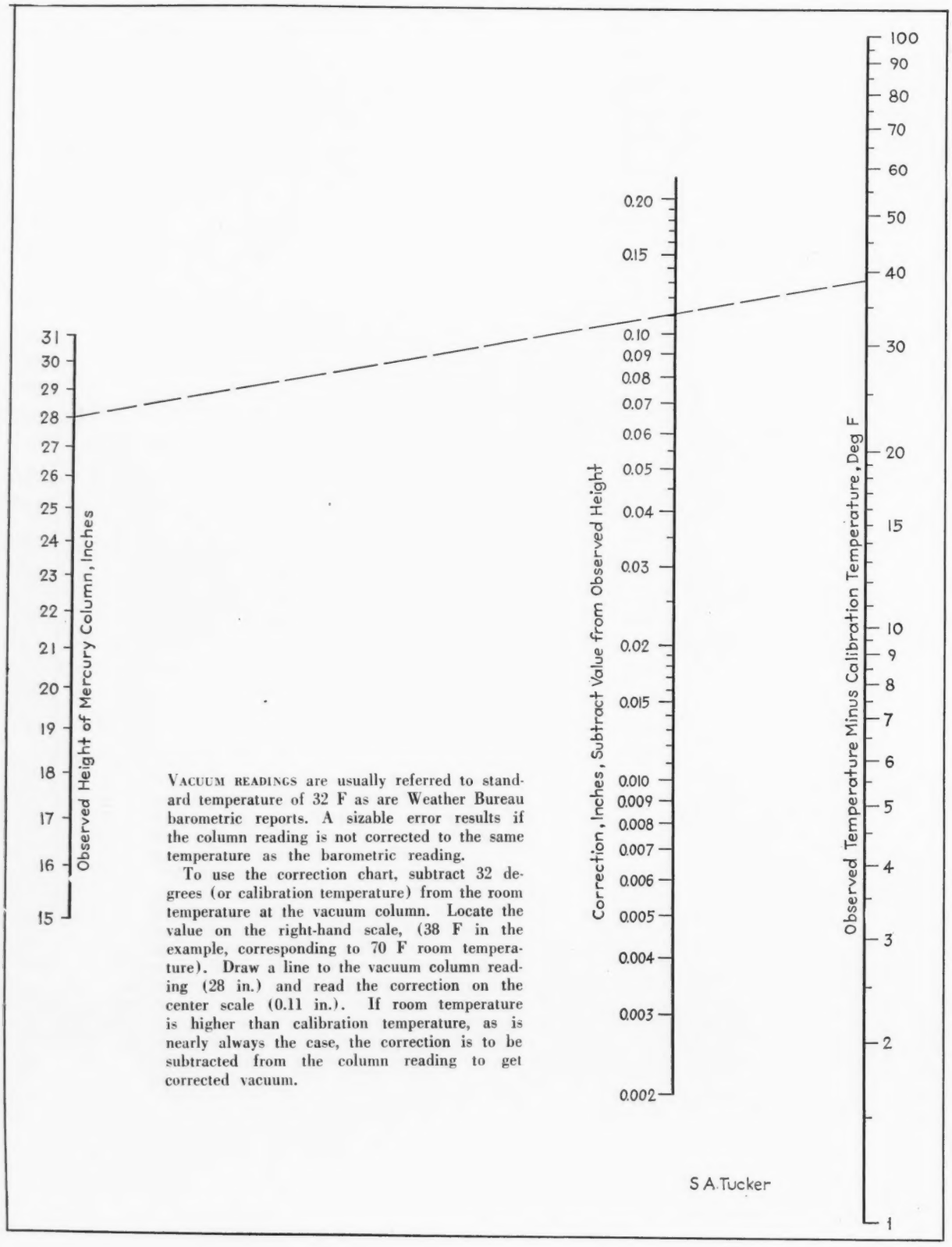
COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • AIR HEATERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • FLUE GAS SCRUBBERS

before purchasing Boiler or Fuel Burning Equipment

Number 71

Vacuum-Column Temperature Correction



VACUUM READINGS are usually referred to standard temperature of 32 F as are Weather Bureau barometric reports. A sizable error results if the column reading is not corrected to the same temperature as the barometric reading.

To use the correction chart, subtract 32 degrees (or calibration temperature) from the room temperature at the vacuum column. Locate the value on the right-hand scale, (38 F in the example, corresponding to 70 F room temperature). Draw a line to the vacuum column reading (28 in.) and read the correction on the center scale (0.11 in.). If room temperature is higher than calibration temperature, as is nearly always the case, the correction is to be subtracted from the column reading to get corrected vacuum.

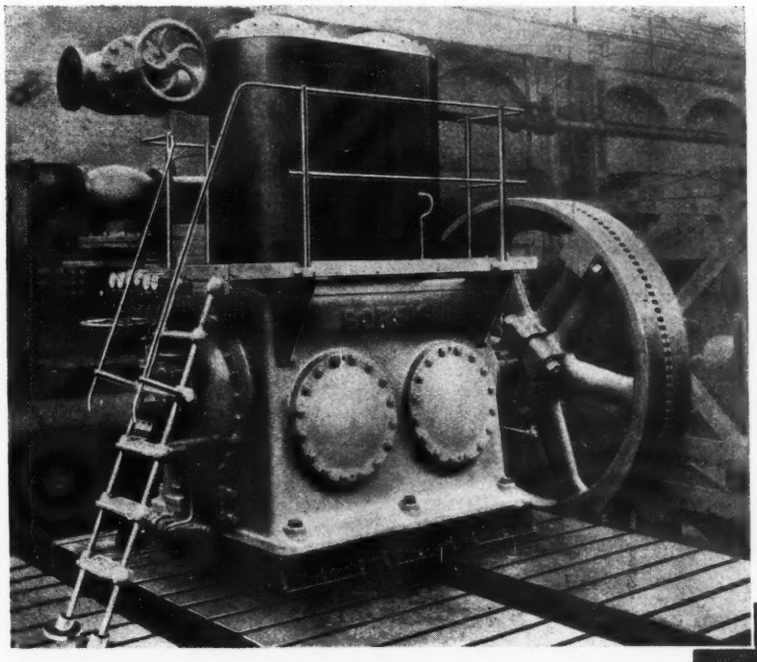
Republication rights reserved

© POWER

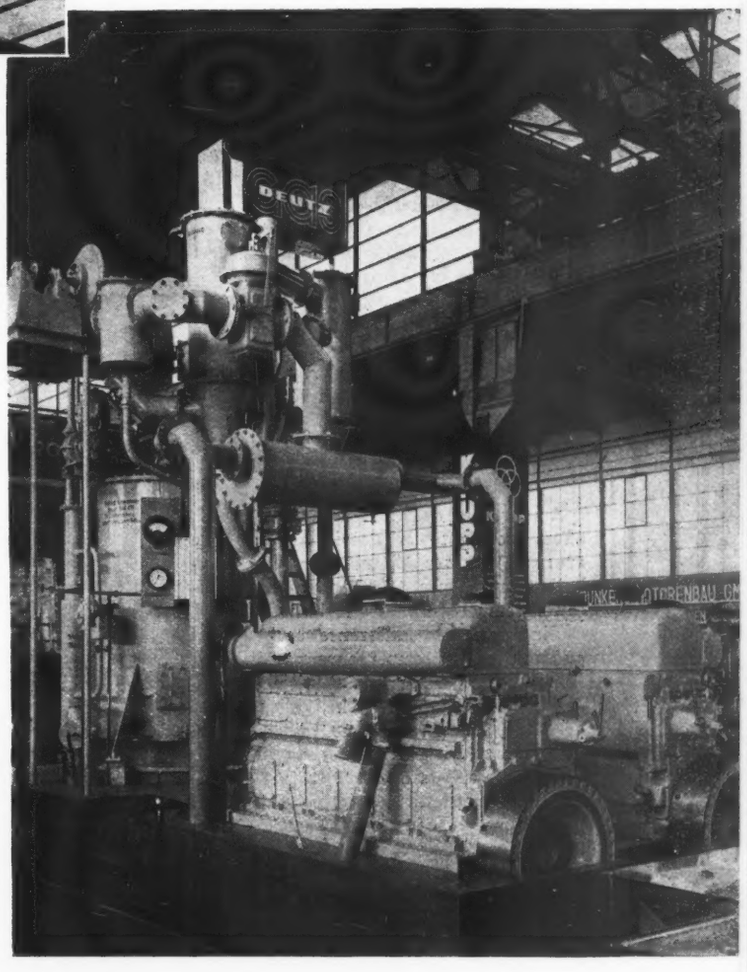
LEIPZIG FAIR

POWER was well represented at the 1938 Leipzig Technical Fair, with almost half again as many exhibitors in this field as last year. Total number of visitors to the Fair was 304,000; buyers came from 72 countries, exhibitors from 32.

In the hall reserved for power-producing machinery, current interest in internal combustion was dramatized by a display of engines operating on gas generated from low-grade coal and wood, Germany's hope in the struggle against dependence on imported petroleum. Gas-generating equipment and engines cost more than other types of prime movers, but offer drastic savings in fuel. The reported ratio between fuel costs of producer-gas units, diesels, and steam, is 1: 2: 2.5.

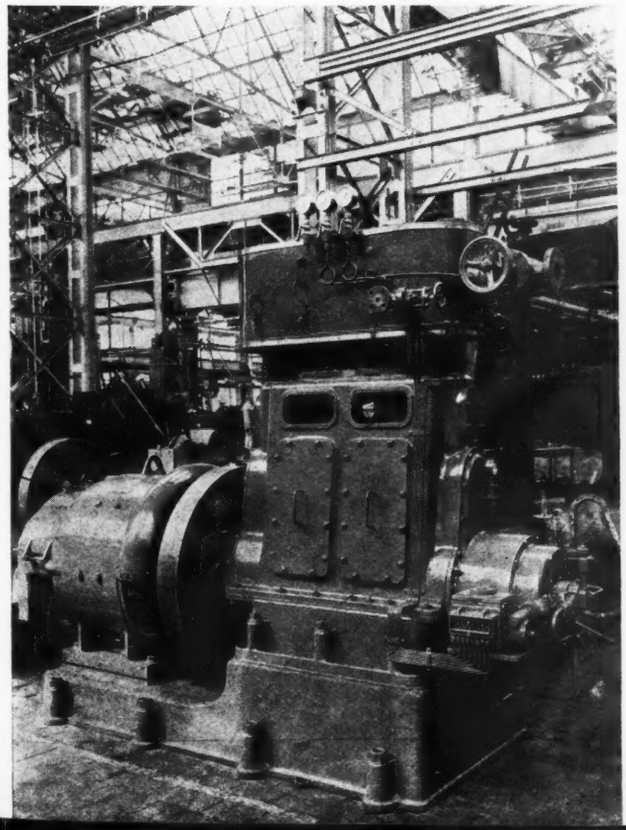


Largest uniflow compressor ever built, this 2-cyl ammonia unit will handle 1,500,000 kilogram-calories per hour, about 500 tons of refrigeration. Rheinmetall Borsig A G, the makers, claim compactness, efficiency, and automatic lubrication as outstanding features



The gas generator and purifier equipment at the left supplies these two 150-hp engines; gas is made automatically from solid fuels such as anthracite, lignite, and peat coke. Humboldt Deutz Moteren A G, the builders, have installed similar sets in 25 vessels of different types

Running at 1000 rpm, with 200-lb throttle steam, and 20-lb backpressure, this vertical twin rotary steam-engine-generator set will produce 130 kw; normal operation is at 600 rpm, 66 kw. Rheinmetall Borsig A G are the manufacturers



Diesels at Dallas

Engineers review progress in equipment design and exchange operating and maintenance data at Annual Meeting of ASME Oil and Gas Power Division

ADVANCES in equipment design and improvements in operating and maintenance methods held the attention of engineers from all parts of the country, assembled at Dallas, June 6-9, for the Annual National Meeting of the Oil and Gas Power Division, ASME.

Reporting on the gas-burning diesel installed in 1936 at the Lubbock, Texas, municipal plant (see Power, September 1937 for description), J J Graham, Superintendent, stated that in the past 20 months, the engine had generated 11,105,100 kwhr, consuming 127,357,000 cu ft of natural gas at a cost of $16,730.96 and 75,000 gal. of pilot oil at a cost of $3000.00. Average fuel cost was 1.7767 mills per kwhr, well below cost if operated on oil, at present prices.

No serious operating problems were encountered with the gas diesel; cylinder wear has been less than on similar oil diesels; lubrication is easier, and valves stay in better condition. In general, this engine takes less time and trouble to maintain than oil diesels in this plant.

Cooling Towers

Aside from design, the factors which affect cooling tower size in a given case are: (1) water circulation, (2) wet-bulb temperature, (3) approach of off-tower temperature to wet bulb, and (4) cooling range or difference between on- and off-tower temperature, said G J Bischof, consulting engineer, The Cooling Tower Company, Inc, in a paper "Cooling Tower Fundamentals and Application to Diesel and Gas Engine Cooling". The effects of these factors on the size of a mechanical-draft cooling tower are shown in Fig. 2, where each curve shows the effect of one factor when the others are kept constant.

In recent years there has been a decided trend to closed cooling systems for diesel and gas engines, according to Mr Bischof, who undertook to establish total yearly costs and analyze the components of these costs for both systems over a wide range of engine sizes (see Power, January 1938). Results indicate that closed systems are economically justified unless soft water is available or elaborate treatment is used.

Presenting a new indicator for diesel engines, K J DeJuhasz, Assoc Prof of Engineering Research, Pennsylvania State College, summed up the problems making diesel indication difficult (high temperatures and pressures, rapid pressure rise, possibility of violent shocks, and drying and corrosive effect of gas) and listed the requirements of a good indicator. The general arrangement and method of operation should conform to that of the normal pencil-type, external-helical-spring indicator; it should be rugged and foolproof. Provision should be made for conveniently large diagram size and the indicator should be suitable for moderately high speeds. The design presented to meet these requirements resembles, in general arrangement, the usual external spring indicator but represents much improvement in detail.

Stressing the importance of trained personnel and leadership, E R Spencer, Asst Chief Engineer, Texas Pipe Line Co, discussed "Essential Factors Contributing to the Success of a Maintenance Program for Diesel Engines". The apprentice system for training maintenance men has been generally successful, he said, offering the following suggestions as supplementary features: (1) a required study program, (2) periodic conferences, (3) demonstrations, and (4) problems for special study and report. With sample forms, Mr Spencer indicated the function of maintenance reports and pointed out that cost records, well kept, give a check on the economic justification of any maintenance program.

With a well-trained organization and adequate records it should be possible to set up uniform procedures for maintenance work. Some of the practices that can be standardized are: (1) hours of operation between general inspections, (2) when crankshaft alignment should be checked, (3) period of operation between valve grinding and reconditioning, (4) when to indicate and check-over combustion, and (5) operating speeds, injection pressures, starting procedures.

Governing

Early diesel-engine governors required some speed droop for stability, were insensitive, had different stabilities at different speeds, and were expensive to maintain. Many of these difficulties have been overcome by the modern oil-pressure governor, according to W J Whitehead, Sales Engineer, Woodward Governor Co, who presented a paper on "Modern Governing Equipment for Internal Combustion Engines". Hydraulic governors are highly sensitive and permit parallel operation with small speed droop. Temporary speed droop or compensation permits arrangement for either isochronous operation or for a drooping speed characteristic. Any amount of speed droop from zero to maximum can be obtained by simple adjustment. Units in parallel can be operated so that all

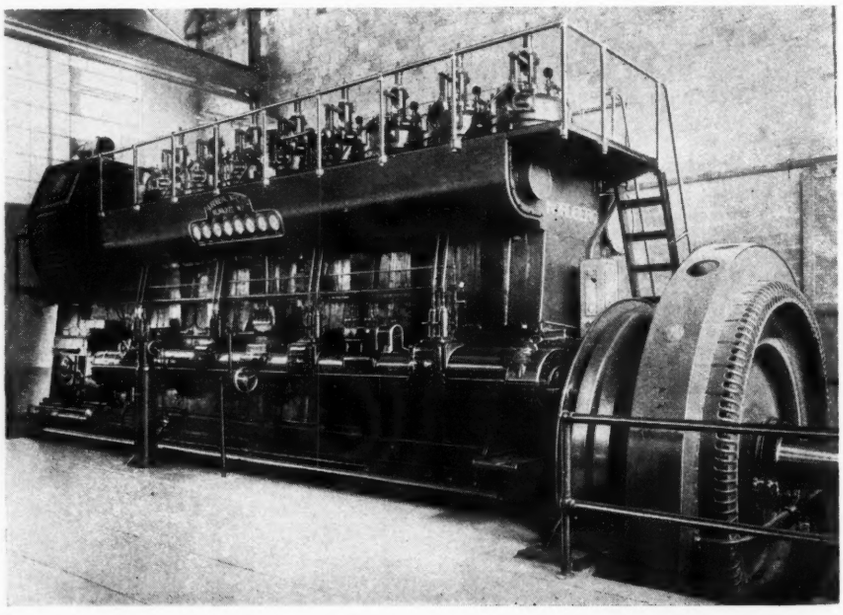


Fig. 1—Gas-burning diesel, rated at 1500 hp, in municipal plant at Lubbock, Tex.

load changes are taken on one machine which regulates the frequency. Fine speed adjustment on hydraulic governors makes for close frequency control and easy synchronization.

Citing many cases of excessive cylinder wear from both steam-engine and diesel practice, Harte Cooke, American Locomotive Co, concluded that lack of lubrication at the exact location where it was needed and excessive pressure behind the piston ring were the main causes of these troubles. Applying lubricating oil directly to the working surface of the cylinder and arranging the ring to balance or eliminate excessive pressures generally overcame difficulties with ring and cylinder wear.

Vibration Isolation

Beginning with typical designs of elastic supports and methods for applying them to neutralize machinery vibration, S Rosenzweig, President, The Korfund Co, in a paper "Theory, Application and Benefits of Engine Vibration Isolation", discussed the nature and usefulness of the materials suitable for use in elastic supports. The importance of the ratio between frequency of rotating equipment and natural frequency of machine and foundation was pointed out, as well as the effect of damping on vibration transmission.

Analyzing the motion of a spring-suspended engine, Mr Rosenzweig pointed out that slight oscillation of the engine is a small price to pay for the advantages

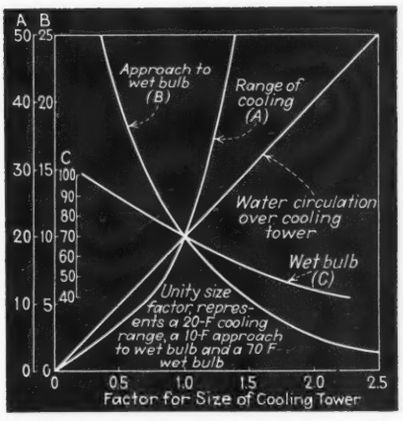

A
B
C
Approach to wet bulb (B)
Range of cooling (A)
Water circulation over cooling tower
Wet bulb (C)
Unity size factor represents a 20-F cooling range, a 10-F approach to wet bulb and a 70 F wet bulb
Factor for Size of Cooling Tower

Fig. 2—Effect of various factors on size of mechanical-draft cooling tower

of isolation. To counteract the disturbing effect of free forces and moments, a stabilizing mass is necessary; a diagram for calculation of foundation weight for a given operating amplitude was presented. Summing up, Mr Rosenzweig emphasized the importance of large frequency ratio, minimum damping, carefully calculated stabilizing mass, and correctly selected isolating materials.

Speaking on "Latest Developments in Diesel-Fuel Testing", G L Stetson, Senior Research Engineer, Shell Petroleum Corp, pointed out that two basic problems are involved in any fuel-oil specification. One is handling from refinery to combustion chamber; important properties in this phase are viscosity, pour point, and cleanliness or ease of filtration. The second problem concerns the actual combustion; important properties here are ignition quality, sulphur content, viscosity and volatility. After analyzing both phases, Mr Stetson concluded that work is needed on: (1) methods of filtering, principally to avoid wax clogging at low temperatures, (2) minor details of the measurement of cetane number and consideration of its significance, (3) a suitable test for rating volatility of blended fuels, and (4) relation between this property and incomplete combustion.

Municipal Plants

Basing his statements on data from over 400 diesel-equipped municipal plants, T B Conner, Fairbanks-Morse & Co, in a paper "Municipal Lighting and Power Systems Go to Town with Diesel Power", traced the preliminary investigations involved in planning a diesel plant, showing how load can be estimated, how unit sizes are chosen, and the consideration to be given to water supply, fuel and lubricating oil, and air. Experience indicates that in towns of less than 5000 population, installed hp per capita ranges from about 0.37 to 0.49, and that kwhr generated per capita per year averages about 450. Mr Conner concluded with data on costs and earnings of municipal plants, and emphasized the need of providing for growth of municipals.

Engineers' Bookshelf

Air Conditioning

TRANE AIR CONDITIONING MANUAL (2nd EDITION—1938). *By William Goodman and Engineering Staff, The Trane Co. Published by The Trane Co, La Crosse, Wis. 333 pages, 8x11 in., 165 illustrations, 75 tables, cloth binding. Price, include air conditioning ruler, pad of psychrometric charts and cooling-load estimate sheets, $5.00.*

Embodying the knowledge and experience of the engineering staff of a company specializing in the manufacture of air-conditioning equipment, this manual presents, in a practical and straightforward fashion, the fundamental engineering facts used in the design of air-conditioning systems. After concise discussions of heat and comfort, the important subject of heat gains is considered exhaustively. Principles are clearly illustrated with practical examples; a method of procedure which is also valuable in the following chapters on properties of air and the psychrometric chart, and calculations for the conditioned air supply. Comprehensive chapters on refrigeration and water supply for air conditioning complete the text.

A valuable collection of reference tables, assembled in one place for convenient use follows the text section. Tables are cross-indexed with the chapters to which they apply. Each chapter has a set of problems illustrating the principles discussed; answers are given. A unique feature is the Trane psychrometric chart and the air conditioning ruler for expediting handling of air conditioning calculations. Throughout the text, the relations involved are illustrated on the chart, making for a clear grasp of the principles involved.

AIR CONDITIONING, FURNACES AND UNIT HEATERS (1938)—*By J Ralph Dalzell, Head, Architectural Engrg Dept, American School. Published by American Technical Society, Chicago. 437 pages, 5½x8½ in., price $3.00.*

Designed to present practical information on air-conditioning principles and methods of application, this book has more than the usual amount of material on furnaces and heating methods, since these elements are most important today, particularly in the residential field where complete air conditioning is still rare. After describing principal types of heating apparatus the author explains air-conditioning principles in a non-technical but complete way, and heat-loss calculations are considered in some detail. The treatment throughout is practical, with many types of equipment and actual applications being cited. Examples and solutions are given to illustrate many of the points.

Oil and Gas Power

DIESEL OPERATORS' MANUAL (1st Edition —1938). *By J W Anderson, Mgr of Engineering, Diesel Engine Div, American Locomotive Co. Published by McGraw-Hill Book Co, 330 West 42nd St, New York, N. Y. 263 pages 4x7 in., 30 illustrations, semi-flexible binding. Price $2.50.*

Not intended to replace engine-builder's manuals but to supplement them, this book attempts in everyday engine-room language to discuss the essentials of safe and economical operation, applying to any engine. Safety gets primary emphasis because of its vital importance and because in the long run it spells reliability and economy of operation.

Installation of the engine, and its starting, stopping, and normal operation get first attention. Then the author discusses specific factors of operation

(*Continued on page* 114)

Readers' Problems

Questions for Our Readers

Disabled Duplex Pump

Question 1

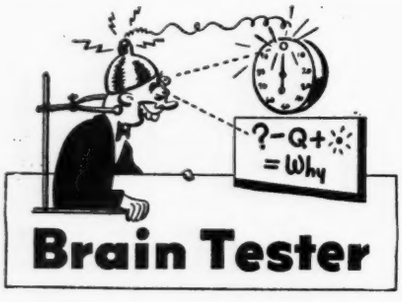
Perhaps some reader of Power *can answer a question asked me recently: "If one side of a duplex pump became disabled, how would one go about getting the other side to run?"—EMF*

Exciters Will Not Operate in Parallel

Question 2

Two of our exciters will not operate in parallel. One of them is rated 7.5 kw, the other, 12.5 kw. Both machines are compound-wound interpole, designed for 125 volts and run at 1200 rpm. One machine is about 40 ft from the busbars and the other about 70 ft. When we attempt to parallel these two units, a heavy cross current flows between them, the circuit breakers open and polarity of one or both the machines reverses. Can some Power *readers tell me what is the trouble?—CRT*

Suitable answers from readers will be paid for if space is available for publication.



Sharpen your wits on this little problem, then check your answer with the one given on page 112.

IT'S A PIPE!

The old P X & Y RR was running a branch line through some dry country, and needed a water station along a particular stretch of track. The only source was two wells located as shown in the sketch. Neither was big enough so water from both had to be piped to the line. Engineer and construction foreman agreed on this and also agreed that to save pipe, the water station should be located at a point along the line which would permit the least amount of pipe to be used. So, as engineers will, the slipstick expert went into a huddle, and when he next visited the job, some days later, proudly announced that he had

calculated the exact spot for the water station; the spot at which the sum of the length of two connecting pipes would be smallest. "That's nice," agreed the foreman, "but the lines are in already—it's a pipe to figure where the water station should be from that little sketch we made." How did he do it?

Coal Segregation

Answers to May Question 1

The Question

We are having considerable segregation in our 5-retort underfeed stoker (layout shown on page 104, May Power*). Retorts on either side receive coarse coal and the retorts in the center get fines. This results in very unsatisfactory burning conditions. We are satisfied that the main segregation takes place at the hopper but are not sure of the best way to prevent it. It is impossible to raise the scales, so limited head room makes it difficult to install a conical feed chute, and we are somewhat skeptical as to the efficiency of vanes.*

Our idea is that a screw conveyor in the chute immediately above the stoker hopper would make it possible to spread the coal over the length of the hopper. Of course, the screw conveyor would be divided into right and left hand in the center. Would it be necessary to have a trough under the conveyor with suitable openings above each retort? What would be the most satisfactory location of the screw conveyor? We would appreciate receiving the opinions of Power *readers on these points, and suggestions as to other possible solutions.—GAS*

Experience Against Screw Conveyor

I KNOW of one installation in which screw conveyors for spreading coal in the stoker hopper were tried. Coal was fed from coal scales to screws operating in troughs with openings in the bottom and at the ends, for distribution across the hopper. There was considerable segregation because the screw agitated the coal and allowed the fines to trickle through to the bottom of the trough. Because of the cost of a screw-conveyor installation, it would seem desirable to experiment with deflectors and guide vanes first.

McKeesport, Pa. C F SCHMARJE

Change Layout and Use Conical Distributor

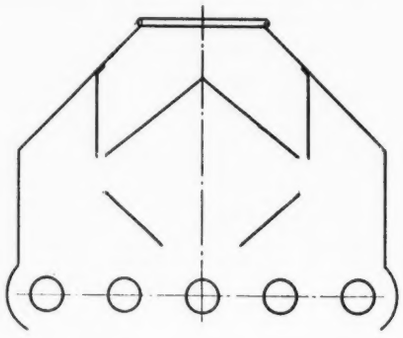
VANES or baffles have been used in chutes to stokers for many years but have little value in eliminating segregation. Furthermore, with the low headroom on this job, there would be so much sticking of coal on vanes that it would be almost impossible to run the stoker. Screw conveyors have been employed on many boilers and were made available commercially a number of years ago. In general, the double-screw conveyor is a spreading device; it is not non-segregating but has a tendency to drop the fines first and carry the coarse toward the outside. Mechanical difficulties are involved in adjusting conveyor operation to hopper conditions.

Study of the plant layout may indicate how a conical distributor could be installed, and the scales removed to some other location. Elimination of segregation will improve boiler performance to a marked degree and the value of doing so will be so great that even the coal scales could be sacrificed if necessary to accomplish this end.

Cleveland, Ohio A J STOCK

Suggests Vanes

IN MY OPINION, a screw conveyor would not answer this problem because there would be a tendency for coarse coal to ride the screw to the ends, letting the fines drop through to the conveyor floor. Properly set vanes would keep the coal thoroughly mixed automatically. The



sketch represents my idea of the placing of the vanes. If the bin is kept well filled with coal, all rams should get the same mixture. Installing vanes is much cheaper than a screw conveyor.

Denver, Colo. P C HANSEN

Change Coal Size

A LOT OF STUDY has been given to coal segregation but it still causes many anxious periods, when fires get short or otherwise refuse to burn properly. As long as we use 1½ to 2-in. screenings we are bound to have trouble. I have tackled the segregation problem in three plants during the past several years, each hav-

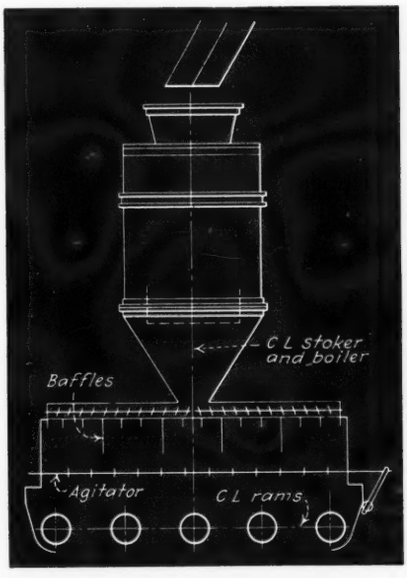
ing different coal-handling and storage equipment. In each plant the problem was whipped by using either ¾ or 1-in. screenings, with part of the fines removed. This coal is delivered in a uniform grade; firemen like it better; boiler capacity is increased; proof is lower steam cost.

Rockford, Ill. C H PAGE

Mount Conveyor on Stoker Hopper

PERHAPS the simplest and most effective scheme would be to mount a center-divided right-and-left hand enclosed-trough screw conveyor directly on the stoker hopper. The present chute would have to be removed and a hopper built as shown in the sketch. This could be done within the space limits, although the scales might have to be moved closer to the boiler to get enough slope on the front side. Openings in the trough fitted with adjustable gates would permit regulating feed over the entire length of the hopper.

As a further safe guard, the hopper can be partially sectionalized with baffles dropped down about a foot below the top. A reciprocating agitator placed directly beneath the baffles might also be used to smooth out unevenness of coal



feed to individual retorts. Such a system would require a great deal of operating attention unless some automatic means of synchronizing conveyor speed with coal demand were used. Other disadvantages are extra power consumption, complexity that might decrease boiler reliability, and added lubrication and maintenance.

With these limitations in mind, it would seem as if vanes might be the most satisfactory way out after all, if properly engineered. If neither method proves practical, effects of segregation can be partially overcome by zoning the stoker windbox to distribute air pressures so that fuel bed thickness and combustion rates are equalized.

Roanoke, Va. S H COLEMAN

Air for Spray Masks

Answers to May Question 2

The Question

Our single-stage air compressor takes air from the engine room and unloads at 100 lb. The receiver is also in the engine room. Air for spray guns and the operators' masks is taken from this system. We are having trouble with oil and moisture in the guns but mostly in the masks. I would like to know whether it is practical to use this air for the masks and if it is harmful to operators.—PP

Lower Compressor Temperature

PP'S QUESTION brings to mind an experience with spray guns and helmets, where defective work and attacks of nausea were found to go together. Air supply was drawn from a small garage-type integrally-mounted compressor and tank unit. Compressor was air cooled and dependent on a built-in fan for what air circulation it got. We finally traced our troubles to the high temperature of the air supply and the presence of minute droplets of entrained oil, although we used the usual cleaner on the gun line.

Since only 15 lb was required, we replaced the single-cylinder air jammer with a rotary blower which, having pressure at the bearings at all times, tended to blow any excess lubricant outward instead of picking it up with the air stream. After cleaning lines of accumulated oil, operation showed we had found the right solution. A similar case of nausea among sandblasters in a foundry was traceable to a hot compressor and was corrected by using an oil of lighter body and by rearranging the cooling-water system to keep outflow temperature below 100 F. The temperature had previously run as high as 150 F.

If PP will try lowering compressor temperature on his present set-up, it is probable that the trouble will disappear. If it continues, switching to a small rotary blower, solely for mask or helmet supply, will soon pay for itself in extended work periods and greater comfort for operators.

Longview, Texas M T PATE

Try Improved Filtering

WE HAVE HAD a similar experience with oil and moisture in spray guns and also when air was used to remove lint and dust. To overcome it, we equipped all outlet stations with small filters consisting of a porous-stone filter element, a sediment and moisture chamber, and a petcock drain. Units were within reach of operator for easy periodic draining. Stones were removed at intervals dictated by experience, and replaced by spare stones. Used stones were soaked in cleaning solvent and kept handy for the next change.

As a further precaution, sediment chambers were placed at the base of all vertical risers, to be drained periodically. An air trap was placed in the receiver drain with an open discharge to a pipe tunnel. Cylinder-oil feed was cut down to a minimum and a volatile liquid was used to clean the suction filter instead of oil (filter was found to retain oil which was sucked into the air stream). The receiver was entered and cleaned each year.

Use of masks with air connections is a source of discomfort to the operator. Our experience in spraying large metal and wood products indicates that with the proper exhaust fans, turntables and modern cartridge-filter masks, operators undergo little discomfort. Breathing air containing moisture and oil, besides being disagreeable, causes inflammation of the mucous membranes.

New York, N. Y. M N KRAUS

Install an Aftercooler

WHEN AIR is compressed, volume is reduced and temperature rises. This heated air is usually pumped into a receiver and distributed to the air lines before it cools a great deal. Water, present as a vapor in the receiver, condenses in the lines as the air cools. This condensed moisture combined with oil from the compressor air cylinder has been a source of trouble for many years. Partial removal has been accomplished in some plants by using separators on individual air lines at the point of use and, where they are drained periodically, these separators have been quite effective. Cooling of the air after leaving the separator is often sufficient to condense additional moisture, which means trouble at the guns or in the masks.

A more positive method, used in modern plants, is the installation of an aftercooler which first cools the compressed air, causing moisture to condense, and then by means of an efficient separator, removes moisture and oil. Where a supply of cooling water with a temperature of 15 F or more below room temperature is available, all moisture and oil can be removed. With higher water temperatures, the aftercooler lowers air temperature to a point where radiation from the receiver will complete the condensation. Moisture is periodically drained from the bottom of the receiver.

Installation of an aftercooler would benefit operators' health, eliminate spoilage and reduce air-system maintenance. First cost is not prohibitive, and water used for cooling is usually sent to compressor jackets afterward, meaning only a slight increase in water cost.

Michigan City, Ind. H C ZILLY

Change Receiver Location

PP'S RECEIVER, located in the engine room, doesn't give the compressed air a chance to cool off so it retains moisture and oil vapor until it gets into the lines. We had similar troubles until the demand for compressed air required installation of a larger compressor and receiver. Intake air was then brought from outdoors and the receiver was

(*Continued on page* 110)

Power Lines

80,000-hp Hydro Project for Oklahoma

The Grand River Dam Authority, Vinita, Oklahoma, has filed with the Federal Power Commission application for license for a large power project to be constructed near Pensacola, Oklahoma.

The proposed project consists of a multiple-arch dam approximately 147 ft high, as measured from bed rock, in and across Grand River near Pensacola, Mayes County, Oklahoma; a reservoir approximately 55 miles long having total storage capacity of 1,680,000 acre-feet at normal pool elevation, and usable storage of 1,000,000 acre-feet with a 40-ft drawdown; a power house immediately below the dam with installed capacity of 80,000 hp in 4 units, with provision in the power station for 2 future units; and the necessary transmission lines for the distribution of the energy to available markets.

The energy generated by the project is to be used for rural electrification, municipal, domestic, and industrial purposes, and will also be sold at wholesale to other public utilities.

Sun Power Research Begun at MIT

With a gift of $647,700 to the Massachusetts Institute of Technology from Dr Godfrey L Cabot of Boston, a research planned to extend for a half-century into the direct utilization of solar energy will shortly be launched at Cambridge. Although details of the program are not complete, the first objective will be to determine whether the use of solar energy by direct methods is economical and feasible, and under what conditions.

Existing devices for this purpose will be studied, followed by an inquiry into the possibilities of their improvement. Later a study will be made of the long-range outlook for conversion. Educational benefits will be derived by student participation under faculty guidance. The Institute's laboratory facilities are already comprehensive for investigating thermal cycles, unusual types of engines, radiation, spectroscopic analysis of material and absorption, colloids and related topics. A committee of the following professors has been named to assist in the direction of this research: Hoyt C Hottel, chemical engineering; Arthur C Hardy, physics; Ernest H Huntress, chemistry; Arthur von Hippel, electrical engineering; and George W Swett, mechanical engineering.

NAPE Annual Meeting

More than 50 manufacturers have reserved exhibit space to date for the 37th Annual Power Show which will be held in conjunction with the 56th Annual Convention of the National Assn of Power Engineers in the Civic Auditorium, Grand Rapids, Mich., Aug 29 to Sept 2. For full information, address Fred W Raven, 176 West Adams St, Chicago, Ill.

Texas Utility to Expand

Houston Lighting & Power Co plans the expenditure of $2,876,664 this year on its construction and improvement program.

The program includes a new steam-electric generating station of 25,000 kw to cost $1,450,000. Other items include the expansion of distribution facilities, $685,045; transmission, $109,000; substation facilities, $101,656; new meters, $175,000; new transformers, $100,000; rural extension, $75,000, and miscellaneous, $81,000.

New Dutch Liner Arrives on Maiden Voyage

Newest of the luxury liners plying the North Atlantic is the 36,235-ton "Nieuw Amsterdam" (Holland-American Line), which arrived in N. Y., May 17, on her maiden voyage. Dimensions of this ship, the tenth largest vessel in regular service, are: displacement tonnage, 36,235; over-all length, 758 ft, 6½ in.; length on water line, 725 ft, 11 in.

Also luxurious and complete is the new ship's power plant. Six Schelde-Yarrow oil-fired boilers (one of which serves as standby), each with a capacity of 60,000 lb per hr, furnish steam at 550 lb per sq in. and 743 F to two sets of four Parsons turbines. Each set contains a 3600-rpm super-high-pressure turbine, a 1600-rpm high-pressure turbine, a 1600-rpm intermediate unit, and a 1250-rpm low-pressure turbine. Combined output of the eight turbines is 34,000 shaft hp.

Each set of turbines is connected to one main condenser, having approximately 13,300 sq ft of cooling surface. The Weir condensers operate at a mean vacuum of 28.75 in. when turbines are developing normal shaft hp. Salt detectors with electrical alarms are fitted in condensate lines of each condenser. Feedwater, obtained by distilling fresh water, is treated with trisodium phosphate.

The three Parsons-type, 750-rpm turbine-generators that furnish electricity for motor-driven auxiliaries generate 1000 kw each and receive steam direct from boilers. Two 425-kw, 220 volt dc diesel-generator sets provide necessary current for port use. The boiler room also contains a 2800-sq ft, 50-lb Scotch boiler, used when the ship is in port for heating and galley purposes. Oil bunkers have a capacity of 4600 tons; consumption is about 230 tons per day.

ABMA Celebrates Fiftieth Anniversary

This year's annual meeting (June 6-8) of the American Boiler Manufacturers Assn and Affiliated Industries marked the completion of a half century of service to the builders of steam-generating equipment. Founded in 1888, the ABMA held its first meeting in Pittsburgh in 1889. Times have changed since then, and the 1938 assembly, like those of other recent years, was set at Skytop Lodge, Pa. As usual, the meeting was 50-50 work and play, the latter mostly golf.

At the opening session, Starr H Barnum reviewed ABMA history, noting that very few trade associations have lived as long. Business sessions were held by members and associate members. Educational features included a B&W colored movie showing boiler-furnace combustion and G E's "House of Magic".

The following new officers were elected: president, Walter F Keenan, Jr, sec-

NO SMOKING

Members of the Smoke Prevention Association at one of the sessions of their Annual Meeting, held in Nashville, Tenn., May 17–20

retary, Foster Wheeler Corp; vice-president, E T Knobloch, secretary and general manager, Union Iron Works; secretary, A C Baker (reelected).

Winners of major golf trophies included: Wells Trophy (members' low-gross 36-hole championship), J H Broderick; associate members' 36-hole handicap championship, tied between C M Daniels and J F Coburn (Coburn won on coin flip).

World Power Conference

A sectional meeting of the World Power Conference will be held this year at Vienna, Germany, where delegates and members will assemble on August 25th for a week of discussion touching all phases of power supply to consumers. Papers and discussions will deal with supply of energy for agriculture, small-scale industries, household purposes, public lighting, and electric railways.

OBITUARIES

Dr Anatoli C Seletzky, 32, associate professor of electrical engineering at Case School of Applied Science, Cleveland, Ohio, died at Lakeside Hospital, Cleveland, May 11, of double pneumonia. Dr Seletzky was considered one of America's most promising young electrical engineers.

Edgar White Wagenseil, 54, sales manager of Hagan Corp, died suddenly May 10, while engaged in official duties. He was a resident of Oakmont, Pittsburgh, Pa.

G B Greene, general manager of The General Supply Co of Canada since its inception, died recently. As successor to Mr Greene, G B Barclay has been appointed managing director of the company.

Hollis C Pettengill, 61, superintendent of the utility steam generating plant in Portland, Me. for 16 years, died in that city recently.

Berford Brittian, 62, for 23 years Chicago representative of Pittsburgh Piping & Equipment Co, Pittsburgh, Pa., died suddenly May 22, at his residence in Hillsdale, Ill.

Herbert L Merrick, president and founder of the Merrick Scale Mfg Co, Passaic, N. J., died May 2. His death terminated an illness of many months.

PERSONALS

Robert T Forbes, 201 Devonshire St, Boston, Mass., has been appointed representative for American Engineering Co, in the New England territory.

A J Jennings has been appointed general sales manager of Cleveland Worm & Gear Co and of its affiliate, Farval Corp, manufacturers of centralized lubrication systems.

Howard Dingle, president of Cleveland Worm & Gear Co and Charles F Goedke, head of Ganschow Gear Co, have been elected by The American Gear Manufacturers Assn to serve as president and vice-president, respectively, for the coming year.

Walter K Dow has been elected vice-president of The Alexander Milburn Co, Baltimore, Md., manufacturers of paint-spray equipment, welding and cutting apparatus, etc. Mr Dow has been plant superintendent of the Milburn Co for the past year.

Alexander V Karpov, well known for his studies of arch dams, left the engineering division of the Aluminum Co of America recently in order to devote his entire time to private practice as a consulting engineer. Born in Russia, Mr Karpov received his technical education in Russia and Germany. He came to

America in 1920, and since his arrival has engaged in the design of hydroelectric developments, bridges, power plants, and dams in association with the Standard Arch Co, New York, and subsequently in Pittsburgh with West Penn Power Co, the City Dept of Public Works, and the Aluminum Co. He was also connected with the Chas T Main Co, Boston. Mr. Karpov has won wide recognition through his contributions to the technical press, and has been chairman of a number of engineering committees.

Meetings

American Welding Society — *Annual meeting (in conjunction with Metals Congress Exposition), October 17–21, Detroit, Mich. M M Kelly, secretary, 33 W 39th St, New York, N. Y.*

Dominion Association of Power Engineers —*1938 Convention, July 8–9, King Edward Hotel, Toronto, Ont. William J Longeway, secretary-treasurer, 130 Dunn Ave, Toronto.*

National Association of Power Engineers —*56th Annual Convention and Power Show, Aug 29 to Sept 2, Civic Auditorium, Grand Rapids, Mich. Fred W Raven, 176 West Adams St, Chicago, Ill.*

National District Heating Assn — *Annual Convention, June 28-July 1, Lord Baltimore Hotel, Baltimore, Md. W H Sanford, secretary-treasurer, 1317 Spruce St, Philadelphia, Pa.*

Technical Association of the Pulp and Paper Industry—*1938 Fall Meeting, Sept 8–10, Northland Hotel, Green Bay, Wis. R G MacDonald, secretary, 122 E 42nd St, New York, N. Y.*

Universal Craftsmen Council of Engineers —*35th International Convention and Great Lakes Power Show & Mechanical Exposition, Aug 2–6, Hotel Hollenden, Cleveland, Ohio. E H Smith, chairman 6523 Euclid Ave, Cleveland.*

H A S Howarth, for 24 years identified with Albert Kingsbury, has set up his own business for design, manufacture, sale and service of thrust and journal bearings at Torresdale, Philadelphia, Pa.

J B Wittrup, for 23 years connected with The Manhattan Rubber Mfg Div of Raybestos-Manhattan, Inc, has been appointed manager of the Chicago mechanical rubber branch.

BUSINESS ITEMS

The Shefler-Gross Co, Drexel Bldg, Philadelphia, has been appointed representative for eastern Pennsylvania by American District Steam Co, N. Tonowanda, N. Y.

W H & L D Betz, consulting chemical engineers, Philadelphia, announce the following: J J McGuire, chemical engineer, who has been on the technical staff for several years, has been appointed assistant technical director; George Bernauer, has resigned his position with the Milwaukee sewage-disposal project, and joined the Betz technical department; and William Gunmere, formerly with American Smelting & Refining Co, has been added to the technical staff.

Roots-Connersville Blower Corp, Connersville, Ind., has appointed the following representatives for sale of turbine pumps: Herman L Krouse, 4217 Buell Drive, Ft. Wayne, Ind.; and A K Howell Co, Syndicate Trust Bldg, St. Louis, Mo.

New York Belting & Packing Co has appointed Boykin Tool & Supply Co, Atlanta, Ga., as distributors of mechanical rubber goods.

Roller-Smith Co, 233 Broadway, New York, N. Y., has appointed Arthur G Miller, Dwight Bldg, Kansas City, Mo., as district Sales agent for western Missouri and Kansas.

Crosby Steam Gage & Valve Co, New York, N. Y., has moved its Chicago headquarters to the Marquette Bldg. Mr Breor will continue as district sales manager, assisted by Charles Dempsey and Douglas Kier.

Cuttler-Hammer, Inc, Milwaukee, Wis., has moved its Cincinanti office to the American Bldg, Central Parkway at Walnut.

Cochrane Corp, Philadelphia, Pa., has appointed C J Gaskell Co, 1011 Falls Bldg, Memphis, Tenn., as district representative for Arkansas, western Tennessee, and northern Mississippi.

Quimby Pump Co, Newark, N. J., has appointed Arch Bowman, Kennedy Bldg, Tulsa, Okla., as representative in Oklahoma.

Trane Co, La Crosse, Wis., has leased space at Bush Terminal, Brooklyn, N. Y., for warehousing and assembly facilities.

NEW PLANT CONSTRUCTION

McGraw-Hill Business News Department Is Prepared to Furnish a More Complete Daily Service

Calif., Jackson—Sierra Mountain Water Co., Box 1023, Route 5, Sacramento, seeking permit from State Division Water Resources to appropriate 300,000 acre ft. per annum from Consumnes River in Amador Co. for power purposes to develop 13,840 hp. $7,500,000.

Conn., New Britain — City, G. J. Coyle, mayor, City Hall, plans seeking Federal aid to construct and equip municipal power plant. To exceed $40,000. Maturity indefinite. Architect not appointed.

Ill., Geneva—City, c/o V. G. Johnson, clk., plans constructing Diesel driven power plant. Wells Eng. Co., Geneva, engrs.

Ind., Culver — Culver Military Academy plans constructing addition to power house, new 625 hp. boiler and generator, rehabilitation feed lines, new ac motors, 100,000 gal. water tank, sprinkler system in mess halls, new boat shop, boat storage building and fireproof warehouse. $200,000 incl. equipment. Maturity this summer.

Ind., Huntington—Acme Eng. Co., Inc., P. H. Clouser, secy., Old 1st Bank Bldg., Fort Wayne, taking bids constructing hydro-electric development along Salamonie River in Huntington Co., near here, incl. 3 dams, one 60 ft. head at "The Narrows," 1½ mi. from mouth of river, one 15 ft. head 6 mi. farther up river and one 30 ft. head 4 mi. above second dam; also 2 hydro-electric power plants. $500,000. Private plans.

Ind., Indianapolis—Link Belt Co., Ewart Works, 220 South Belmont St., soon lets contract 1 story, 51x60 ft. brick, rein.-con., steel addition to boiler house, with 175 ft. 7 ft., 6 in. radial brick stack, South Belmont St. Austin Co., 16112 Euclid Ave., Cleveland, O., engrs.

Ia., Belmond—City, c/o City Clerk, held election June 20, to vote $120,000 bonds constructing municipal light and power plant, equipment, etc.

Ia., Larchwood—City, c/o M. G. Solon, clk., takes bids about June 26, constructing new engine house building, one 200 hp. diesel engine and changing distribution system from direct to alternating current. $24,800-$28,000 Buell & Winter Eng. Co., 508 Insurance Exchange Bldg., Sioux City, engrs.

Ia., Mount Pleasant—City soon lets contract furnishing, installing 1,000 kw. turbo generating unit, duct work, condenser, circular pumps and drives, air ejector, condensate pump, steam piping, exhaust piping, water piping, hangers, support.

Ia., Spencer—City making surverys constructing light plant improvements. Burns & McDonnell Eng. Co., 107 West Linwood Blvd., Kansas City, Mo., engrs.

Kan., Kansas City—City plans constructing new 25 m.g. per day steam power pump house, brick, rein.-con., at Quindara Plant. $350,000. Engineer not appointed.

Mich., Hillsdale—City, R. L. Hughes, clk., plans nearing completion by Hamilton & Weeber, engrs., 1440 Mackinaw Rd. S.E., Grand Rapids, constructing 2 story, brick steel, concrete addition to power plant, plain found. $190,000.

Minn., Sherburn—Village, c/o E. Risley, clk., plans municipal electric power plant, equipment and distribution system. $100,000. Making plans to issue $30,000 bonds.

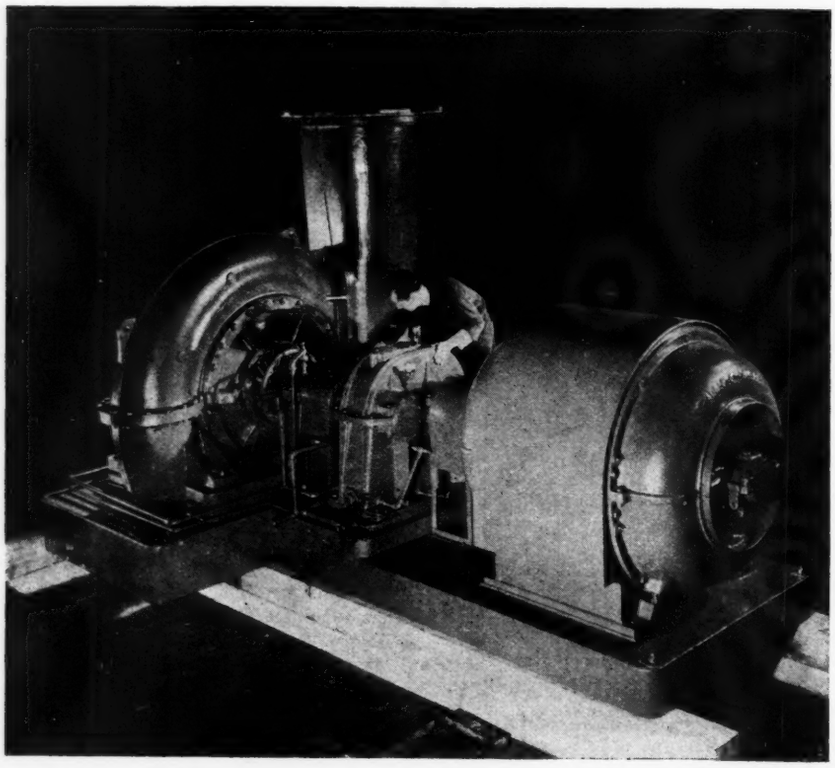
Minn., Truman—Village, c/o R. L. Krause, village clk. voted $50,000 bonds for constructing power plant, electrical equipment and distribution system. Total cost $104,000. Noted Apr. 28, CD.

Mo., Carrollton—City, O. Brunsworth, city clk., plans constructing power plant building and equipment, etc. $235,000. Preliminary report made. Burns & McDonnell Eng. Co., 107 West Linwood Blvd., Kansas City, Mo., engrs.

Mo., St. Louis—American Refrigerator Transit Co., Missouri Pacific Bldg., 13th and Olive Sts., soon takes bids 4 unit, refrigeration warehouse. First and Barton Sts. $250,000. Construction Div. Missouri Pacific R. R. Missouri Pacific Bldg., archts.

Neb., Alliance—City Council approved plans constructing new plant building, new turbine, new boiler, setting foundations for 2 turbines and another steam unit in present plant. $330,402. Black & Veatch, 4706 Bway., Kansas City, Mo., engrs.

N. J., Greystone Park—Institutions & Agencies, Trenton, soon lets contract steam driven 500 kw. condensing bleeder turbo-alternator and one surface condenser and auxiliaries, for New Jersey State Hospital. $4,500.



ARIZONA-BOUND SCAVENGER

One of the two Allis-Chalmers scavenging turbo-blower units for the two, 2-stroke, double-acting diesels built by Hooven, Owens, Rentschler for the Salt River Valley Water Users' Assn, Temple, Ariz. Each blower unit, rated 32,000 cfm at 2.0 lb g and 3550 rpm, is driven by a 400-hp, 1450-rpm motor through speed-increasing gears

N. C., Newton—City plans constructing generating system for electric current. E. Haupt, mayor.

N. C., Shallotte—Town, R. D. White, chn. Electric Comn., plans constructing power plant to supply town and nearby territory. E. D. Bishop, mayor.

O., Cleveland—City, F. O. Wallene, dir. Public Utilities, making plans constructing 1 story light plant addition, installing 25,000 KW. turbo-generator $2,131,000, replacing Boilers 10 to 14, $325,000, and generator units. $2,927,000, East 53rd St. Total $5,000,000. P. F. Loftus, Oliver Bldg., Pittsburgh, Pa., engr.

O., Columbus—City, L. Lewis, dir Pub. Serv., plans constructing municipal light plant extension approved by P.W.A. $1,030,000. Sale of $820,000 bonds for construction of same approved by City Council. P. W. Maetzel, city engr.

O., Fairport—Village election Nov. 8 to vote $155,000 bonds constructing 1 story electric light plant and distribution lines. J. M. Crabbs, Johnson Bldg., Painesville, engr. P.W.A. project.

O., Painesville—City, W. L. Clipp, clk., soon lets contract constructing 1 story, 30 ft. high, 20 ft. basement, 50x80 ft. turbine room addition, $40,000, and 15 ton crane for light plant. H. R. Hadlow, 700 Prospect Ave., Cleveland, engr.

O., Wellston—City plans improving municipal light plant, incl. installing new 1,000 kw. turbine and 2 boilers. $125,000. H. R. Lasley, dir. Pub. Serv. H. Frantz, city engr.

O., Wooster—Wooster College, plans by W. E. Reed, archt. and engr., Union Trust Bldg., Pittsburgh, Pa., constructing power plant. $200,000.

Okla., Cherokee—City plans election soon to vote bonds for enlarging and improving light plant. $120,000. C. H. Guernsey, Cherokee, engr.

Pa., Johnsonburg—Borough, H. A. Miller, secy., plans purchasing electrical pumping machinery and equipment for municipal sewage disposal plant. To exceed $1,000. Perring & Remington Co., 6100 Ellsworth St., Phila., engrs.

Tenn., Chattanooga—Bids June 22, by Electric Power Bd., N. J. Simmons, secy., City Hall, grading, draining, fencing, foundations, substructures and buildings for 44 kv. Substations 3 and 6, P.W.A. Project Docket Tenn. 1105 P-DS; electric distribution system. Sub-Project Contr. 3-C. $100,000. S. R. G. Finley, City Hall, ch. engr.

Tex., Greenville — City plans constructing municipal light and power plant, diesel engine unit, etc. $100,000.

Tex., Huntsville — Texas Prison System, State Bd. Control, Huntsville, taking bids constructing electric power plant, incl. diesel motor unit to generate electric power for entire prison plant, approximately $75,000, replacement of all eelctric equipment and machinery of execution chamber, replacement of all supplementary electric equipment. Total est. $125,000 or more.

Wash., Yakima—Pacific Power & Light Co., Yakima, preparing plans constructing outdoor type sub-district power station. Lenox and South 14th Aves., to be served with 11,000 volt feeder. $60,000. A. E. Bond, c/o owner, engr.

W. Va., Newell—Homer Laughlin China Co., A. A. Wells, plant supt., plans 3 new boilers and other steam generating equipment in No. 4 plant involving rebuilding power plant, automatic stokers and combustion controls, new boiler feed water pumps and new ash handling are to be included in equipment to be installed, also 150 ft. brick chimney will be constructed as part of rehabilitation project.

Wis., Milwaukee—Nunn Bush Shoe Co., 2822 North 5th St., plans constructing power plant at shoe factory, 2822 North 5th St. $50,000.

Wis., Wisconsin Rapids — Wisconsin Power & Light Co., Madison, plans constructing electric light and power plant improvements. To exceed $40,000.

B. C., Lillooet—Lillooet Power, Water & Light Co. Ltd., P. J. Wilson, K.C., in charge, preparing plans hydro-electric plant. $75,000.

Ont., Sudbury — Ontario Hydro-Electric Comn., Toronto, constructing concrete dam to replace present wood structure at Coniston power plant, day labor. $275,000. Private plans.

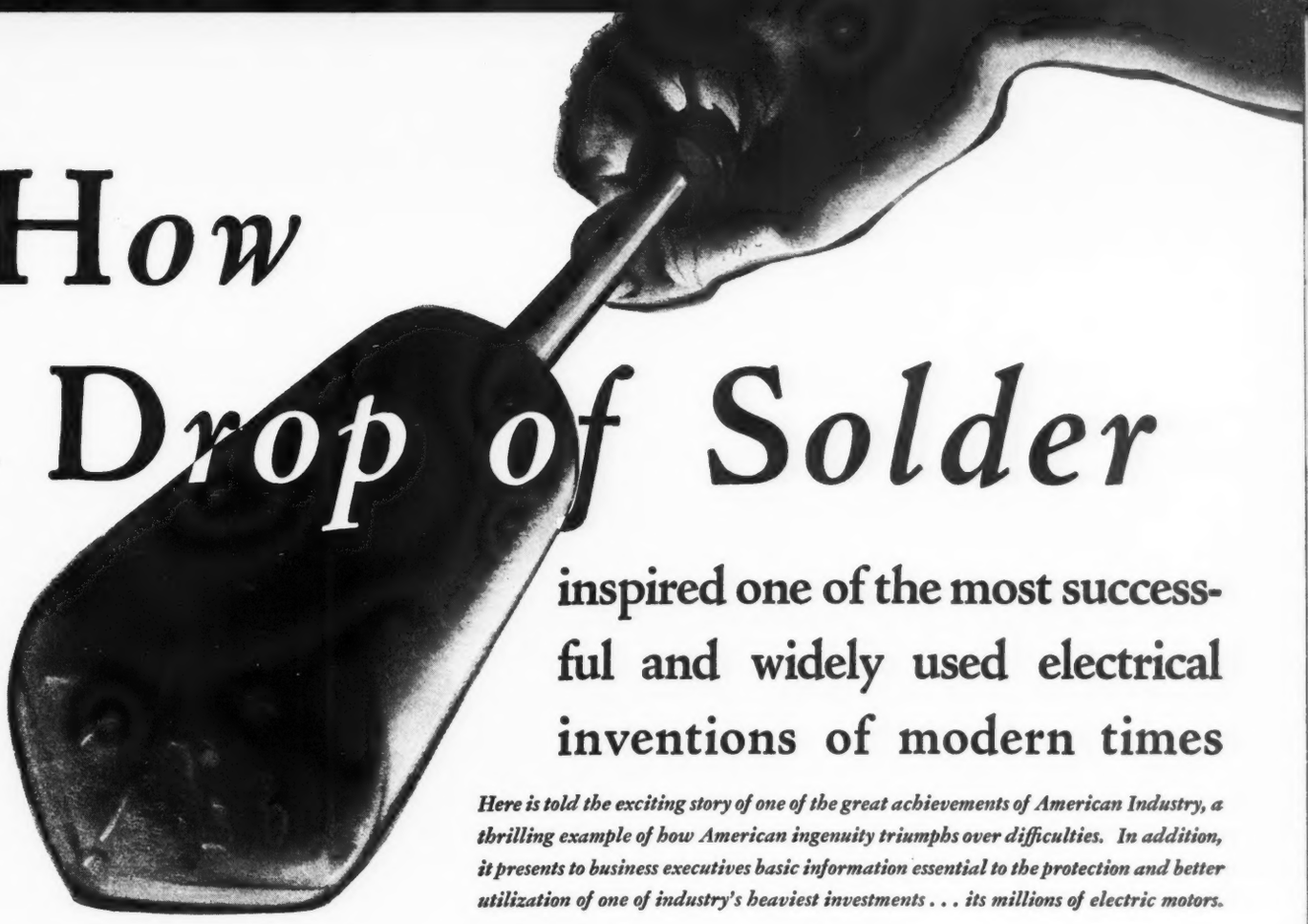
Que., Louzon — Secretary Dpt. P. Wks., Ottawa, Ont., soon takes bids constructing new power house, pump house equipment and machine shop on Lorne Dry Dock. $205,000. The amount of $125,000 will be spent now. K. M. Cameron, Ottawa, Ont., engr.

Que., Montreal—Power Corp. of Canada, Ltd., 355 St. James St. W., preparing plans raising head of water at Quinze River plant, at Ka Ke Falls, to provide additional 20,000 hp. $1,500,000. Private plans.

Que., Montreal—Reverend Sisters of Charity, plans by J. D. Viau, 59 St. James St. W., constructing and equipping power house, St. Jean de Dieu St., $45,000.

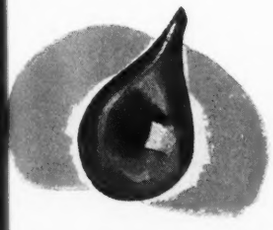
Cyprus, Famagusta—Callenders Co. of London, England, to undertake power development and construct electric power station. $950,000 (initial).

How a Drop of Solder



inspired one of the most successful and widely used electrical inventions of modern times

Here is told the exciting story of one of the great achievements of American Industry, a thrilling example of how American ingenuity triumphs over difficulties. In addition, it presents to business executives basic information essential to the protection and better utilization of one of industry's heaviest investments . . . its millions of electric motors.



An electric motor does not know when to quit. It will do anything under high heaven to move the load put upon it. Even when the load becomes too great, the motor still strains and struggles, drawing current from the line until its windings char and burn, not only destroying itself but disorganizing the operations in which it plays a part.

For more than a quarter of a century the world's engineers wrestled with the problem of a device that would let a motor work up to its limit, but not a step beyond; a device that would protect but would not stop the motor on mere temporary and harmless overloads. Many were the answers through the years, but they were clumsy, expensive, inaccurate or undependable.

Then, one day, a young designing engineer watched a bit of solder melt . . . and freeze again. That gave him an idea. He looked for a metal or an alloy of metals that would have an unvarying melting point, that would hold like a bulldog until that point was reached—and would then suddenly *let go!*

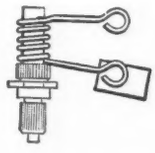
At last it was found . . . and then a group of Cutler-Hammer engineers worked out its application. They took a tiny bar of metal an inch long, an eighth in diameter. They made a sheath for it, scarcely large enough to permit the bar to rotate inside it. They dipped the end of the bar in the melted alloy, hastily pushed the bar into its sheath. The alloy *froze,* clamping bar to sheath immovably. When heated the bar would rotate. When cooled, it was rigid.

This was the birth of the now famous Cutler-Hammer Eutectic Alloy Thermal Overload Relay . . . in principle just as it is used today to protect millions upon millions of electric motors . . . nearly 2 million in American homes on refrigerators and other domestic appliances, and several millions more in America's factories. But this was only a beginning. Between the principle revealed and a practical, dependable device capable of low cost mass production was a great gulf . . . a gap Cutler-Hammer engineers, alone, have so far been able to span.

The story of the refinement and perfection of the Cutler-Hammer Thermal Overload Relay would require a book. The story of the attempts to imitate it, to duplicate it, to emulate it would fill another. The story of its manufacture, the tests and inspections it must undergo would fill a third. As a matter of fact, the success of the Cutler-Hammer Thermal Overload Relay —and it is a success almost without counterpart in the history of Motor Control—is as much a tribute to modern laboratory-controlled manufacturing as it is to the engineering genius that conceived the principle.

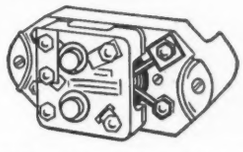
The C-H Eutectic Alloy Unit

When you think how other methods of constructing a dependable overload device have failed, how *this* capsule mechanism accurately reflects the changing conditions in the motor's windings, and assures the safety of untold millions of dollars of motors and machines and products and profits, you begin to see what an achievement this was, and one reason why Cutler-Hammer Motor Control is respected beyond all others wherever electric motors are used. CUTLER-HAMMER, Inc., *Pioneer Electrical Manufacturers,* 1358 St. Paul Ave., Milwaukee, Wis.

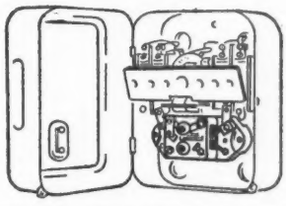


Heater Coil Melts Eutectic Alloy

This coil carries the current going to the motor and is so selected that the heating produced is exactly proportional to heating within the windings of electric motor itself. It arrives at the temperature which melts the C-H eutectic alloy at the very point where heating within the motor becomes dangerous to the motor windings. When this "drop of solder" melts, it allows one part of the unit to turn, which through a mechanical arrangement opens the circuit, stopping the motor. A simple "reset" button restores service . . . no parts to replace . . . no adjustments needed.



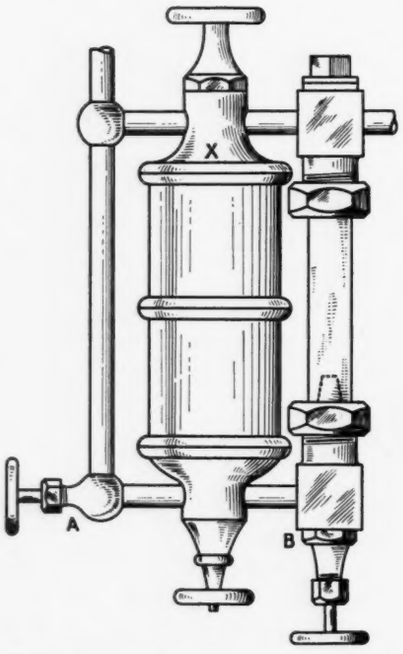
C-H Eutectic Alloy Thermal Overload Relay Assembly



Position of overload relay in a typical unit of Cutler-Hammer Motor Control

CUTLER-HAMMER
MOTOR CONTROL
C-H

Practical Aids to Operation



Oil Expansion Ruptures Lubricator

SOME YEARS ago I represented a force-feed lubricator company in New England. Some of my experiences were an education in the power field. In a rubber mill, a lubricator had served a large Corliss engine for over 20 years without trouble, but the morning I arrived, it had badly ruptured. The engine operated only during the day, and the day before the failure occurred, the spare engineer was in charge.

What at first seemed a deep mystery was soon solved to the satisfaction of the chief engineer. The spare man wanted to leave everything shipshape for the regular engineer, so the last thing at night, he filled the lubricator with cold cylinder oil and left valves *A* and *B*, above, closed. When the oil heated, it expanded and ruptured the lubricator at *X*.

New York, N. Y. C W PETERS

Brazing Diesel Cylinder Heads

I HAVE been quite successful repairing cracks in diesel-engine heads by brazing instead of using the usual cast-iron weld. My method of doing this work is as follows:

Assume that the head is about 1.5 in. thick. Cut a vee about 1.5 in. wide and taper to 0.25 in. at the bottom. Make the groove as deep as posible without breaking through into the water compartment. It is advisable to drill a 0.25-in. hole through the crack to determine the metal thickness and to serve as a guide in cutting the groove. All sharp edges should be removed where the chipping is done and corners rounded off, to assure a good bond between brazing material and cast iron.

Put the head in a preheating furnace, which may be constructed of loose fire brick. If oil, coke or gas is not available for fuel, wood may be used. Cover the furnace top with a sheet of asbestos, blocked up to allow gas to escape. Heat the head to a near dull red. When the head is removed from the furnace for brazing, keep it out of strong air currents. Several preheatings may be necessary to do the job properly.

After brazing is completed, peen the metal, return the head to the furnace and heat to a dull red. After this, close all openings in the furnace and cover its top with sand so that air currents cannot come in contact with the head. Permit the furnace to remain this way for at least 24 hours, then remove the head and again peen the brazed metal to relieve strains. When the head is cool, pour a 50-50 solution of muriatic acid and water into the head and let it stand until all scale is removed. Machine the head if necessary, and the result is a job that will stand up, unless the engine is run without cooling water or scale again accumulates in the cooling-water chamber.

Barranquilla, Colombia, S. A.
C A VAN DEURSEN

Lengthening Tube Life By Changing Blowdown

BLOWING DOWN a watertube boiler may disturb seriously normal circulation of water in steam-generating tubes, under certain conditions. In a bent-tube boiler, the blowdown line usually connects with a so-called mud drum of considerable size and capacity. However, with the straight-tube, sinuous-header boiler, a wide open blowdown valve may remove a large proportion of down-coming boiler water. Starvation of the lower row of steam-generating tubes in this vicinity may result.

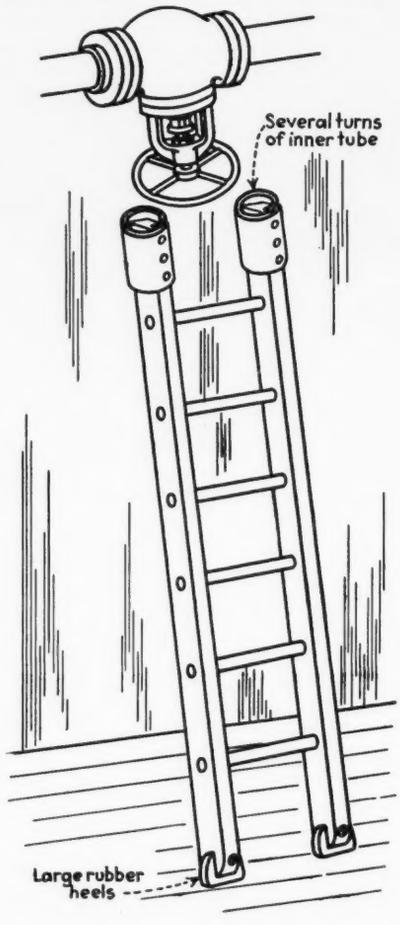
A recent instance of tube troubles occurred in a straight-tube, sinuous-header water-tube boiler. The bottom row of tubes on one side of the boiler developed leakage at the front expanded ends. Bulging of these tubes in the form of a ripple also resulted. Flame impingement was first suspected, but a close investigation showed no indications of this trouble. Tests on the tube material showed no defects and operating conditions were then checked.

It was found that before blowing down the boiler, water level was raised to near the top of the gage glass, and then blown down to normal. This required about 3 to 4 min. with one blowdown line under full flow. The leaking tubes were supplied by down-comers located close to this blowdown line, and a further check showed that the load, at time of blowing down, ranged close to 200% rating. When time of blowdown was changed to light-load periods, no further tube trouble occurred from blowing down.

Cleveland, O. A C WIGGINS

A Homemade Non-Skid Ladder

LADDERS used on slippery floors or on smooth plates should have non-skid feet. Many good types are on the market and are, of course, preferable



Yarway performance talks. Their quicker heating and greater sustained heating efficiency soon pay for their installation and continue on to return worth-while profits in plant operating economy. And when you consider that their purchase price is usually no more than the cost of repairing an ordinary trap—why not *get* Yarway performance for *your* money?

Install a Yarway Impulse Trap or two and let them demonstrate what they can do for you in *speeding production* and *saving fuel.* See how its *small size saves space.* How its *light weight simplifies installation.* How its unique design with *only one moving part,* and its *rugged bar-stock construction,* practically *eliminate maintenance expense.* Then too, Yarway Traps are suitable for all pressures *without change of valve or seat.*

A nearby Mill Supply Dealer handles Yarway Traps and will be glad to serve you. Or write for Catalog T-1733.

YARNALL-WARING COMPANY
100 Mermaid Ave. Philadelphia

YARWAY IMPULSE STEAM TRAP

to homemade designs. However, in a pinch, you can make a ladder safer by putting rubber heels on the bottom ends and by wrapping a section of rubber inner tube around the top ends, as in the figure. Extending the inner tube beyond the ends of the side pieces, provides a flexible type of non-skid gripping surface.

Penacook, N. H. C H WILLEY

Copper Tie Wires Reduce Maintenance

MAINTENANCE of heat-insulating coverings on power-service piping and equipment can be substantially reduced by proper selection of tie-wire material. In general, if wire is not exposed to temperatures over 300 F, copper wire is much superior to iron or steel for fastening the sections or blocks to heat-radiating surfaces. Copper, though less strong than ferrous wire (a weakness that can be compensated for by using a heavier gage), has a number of advantages. Among these are: greater ductibility, making it less likely to be strained beyond its elastic limit when wire ends are twisted together, which reduces the possibility of breakage in service; and its great resistance to ordinary corrosive mediums.

Ability of copper to withstand corrosion is extremely important in the presence of moisture, vapor or active gas. For this reason, copper tie wire should always be specified where sweating occurs. Where insulation or its moisture-proof covering is exposed to weather, dampness, or other deteriorating influences, copper is also preferable.

Lynchburg, Va. O M ROBERTS

Prolongs Life of Old Conveyor Belt

ABOUT 12½ years ago, a large eastern power plant installed a 1500-ft, 8-ply, 36-in. conveyor belt for coal handling. Since that time, this belt has handled an average of 1000 tons per day. Recent inspection showed the belt to be in good condition with the exception of about a dozen cuts in the cover, some of which extended into the fifth ply. Realizing the importance of closing such cuts against the entrance of grit and moisture, the owner decided to have the damaged places repaired.

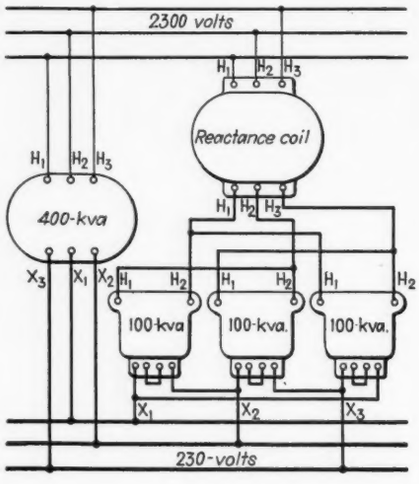
Fig. 1 shows the first step in the repair operation which consisted of cutting away that portion of cover and plies surrounding a cut. Then, this open area was filled in with new ply fabric, as in Fig. 2. After the required

number of plies had been cemented into place the rubber cover stock was applied. Final step in the curing of the repaired area was accomplished with a special portable electric vulcanizer.

Akron, Ohio R W SMITH
B F Goodrich Co

Paralleling a Group of Transformers

PART of the auxiliaries in a power plant were driven by motors supplied from a 400-kva, 3-phase transformer. Another group of auxiliary motors were connected to a bank of three 100-kva, single-phase transformers. As the plant increased in size, auxiliary load was added until the 3-phase transformer was in danger of being overloaded.



Because of the plant arrangement and low-voltage wiring, it was not considered advisable to increase the load on the transformer bank, even though it had considerable spare capacity. As a solution to the problem, the transformers were moved to one location, for the purpose of connecting the single transformer in parallel with the bank and thus obtain 700-kva combined capacity.

The transformers were phased out with a motor and connected in parallel, but when the line switch was closed the primary fuses opened. It was thought that the impedance of the 3-phase transformer and the bank did not match, and a reactance coil was ordered from the transformer manufacturer. But installation of the reactance did not help matters, and the problem entered a stalemate with the customer claiming a faulty reactor and the manufacturer, improper connections.

Several years later, a solution of the problem had to be found or a new transformer had to be purchased. It was then found that dissimilarity existed between the delta-connected 3-phase transformer and the delta-connected 3-phase bank. Successful paralleling of the transformers was finally obtained with the connections shown in the figure.

Hibbings, Minn. A L BENNETT

Safety Suggestions for Maintaining Switchboards

DURING normal power-plant operation, it is often necessary to make minor repairs or alterations to current-carrying parts of live switchboards. When work of this kind is undertaken, the engineer in charge should exercise every care to prevent injury to the workmen and to safeguard continuity of service.

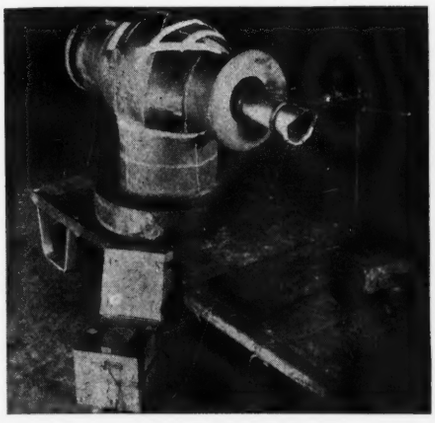
Wherever possible, current should be off the circuit, fuses removed and adjacent live parts isolated. Switches which have been opened to kill the circuit should be locked or blocked in

Photo News Valve values

THE EDWARD VALVE & MFG. CO., INC. • EAST CHICAGO, INDIANA

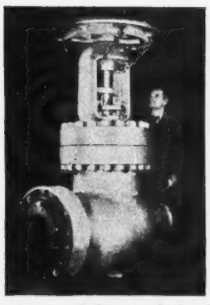
EDWARD VALVES GIVEN TOUGH JOBS . . .

PICKED FOR KEY POSITIONS IN NEW PLANTS - - - SUPREME MATERIALS, PRECISION MACHINING, SOUND DESIGN, MARK RECENT INSTALLATIONS



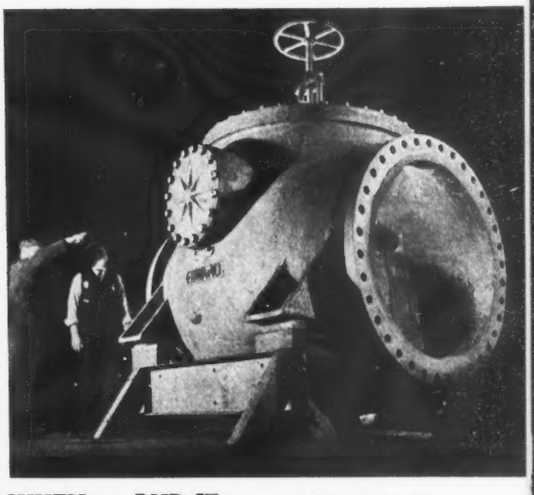
RADIUM'S GAMMA RAYS are utilized by Edward to explore intra-mural spaces of steel castings. Looking "inside" helps improve control of tricky variables of steel foundry practice. For safe handling, radium capsule is manipulated by long strings. Thin lead sheets placed in film holder with X-ray film serve both to intensify image formed by rays and to protect research workers.

ANOTHER INSIDE VIEW — this time of normally invisible stress lines — is used by Edward to learn where seats and disks most need strength — and why. Bakelite models of essential outlines of operating parts show what goes on when light is diverted from its course by polarizing screens. Useful for problems the mathematics handbooks can't solve. Valve users benefit by freedom from service failures.



THEY'RE BIG, HEAVY, and according to advanced piping ideas, these new Edward non-return valves. One boiler out of an extensive topping battery is discharging its 900 F steam through this 12 in. 1500 lb SP giant. Inlet is bolted to boiler outlet, while valve outlet is welded to pipe.

X-RAY CHECK of welded pipe joints make steam and water circulation systems practically integral in new boiler houses. But some flanged joints are needed. Edward workman is scraping Sarlun face to precision gasketless contact. He checks work with sensitive dial indicator and surface plate in background. (Body covered with lime wash to check distortion — and of course there was none — under protracted high pressure hydraulic test.)



WHEN — AND IF — a turbine loses its vacuum, steam must be bypassed around the condenser to atmosphere quickly and adequately. Big turbines need big atmospheric relief valves, like this 42 in. unit. This is not top size for Edward, and its controls are less complex than some, but it weighs around 14,000 lb.

LOOKS LIKE A LOT of blow-offs! And naturally, because Edward builds lots of valves for high pressure blowdown service — from 150 lb to 1500 lb, and up if need be. Study cut closely and you'll see angle and straightway valves of dependable disk design, of amazing simplicity and fitness of detail, embodying Edward's thirty years' blow-off valve experience.

WHY DO SEATS sometimes loosen under high temperature service? Several factors may be responsible. In these valves precedent set in welding pipe joints was followed one step further by welding seats into bodies. Holes were cut in bodies for introduction of electrodes to seal seats to diaphragms. After welding holes shut bodies were heat treated and then finish machined. Valves are for 1950 lb service.

EDWARD VALVES

Stop · Check · Blow-off · Non-return · Feed Line · Relief · Bleeder Line · etc.

open position and suitable warning tags attached. Keep switches locked out until the workman making the repairs personally reports the job completed and all persons in the clear. This report should be made to someone in a responsible supervisory position who can check for errors before ordering the switch closed. Ground the circuits until work on them is finished, as a further protection against their being inadvertently energized.

Never open a current-transformer secondary circuit while the primary is energized. Short circuit the secondary before opening the circuits running to meters, relays, or other equipment. If this is not done a very high voltage will be developed in the secondary which may endanger the life of workmen or cause the transformer insulation to fail. If work must be done on live circuits, use rubber gloves and insulated mats. Test these devices frequently to be sure they are in condition to withstand the highest possible voltage which might be imposed on the part undergoing repairs or any of the other circuits in the immediate vicinity.

All tools should be insulated to prevent possibility of grounds and short circuits. Under no condition, however, depend on tool insulation to safeguard men doing the work. Such insulation is often injured and is notoriously unreliable. Workmen should use the same care as they would with uninsulated tools.

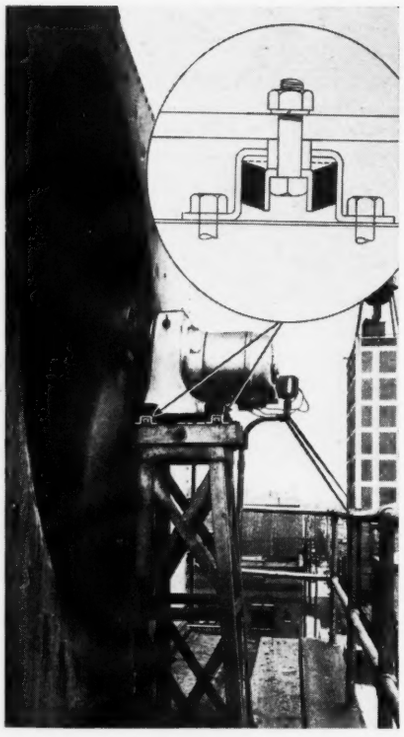
Long-handled wrenches have been the cause of short circuits. Use socket wrenches if possible. A convenient socket wrench for the nuts of instrument and relay studs can be made from a short piece of copper tubing. Run several nuts on a spare stud, face them up and insert them in the tubing. The copper can then be easily hammered into the desired shape. Layers of tape wound on the handle end will make a workable grip.

Roanoke, Va. S H COLEMAN

Mounting Eliminates Gear and Fan Noise

A LARGE airplane-type fan driven through a reduction gear supplies air to a water-cooling tower, in the plant of Industrial Cold Storage Co, Philadelphia, Pa. The whine of the gearing was so loud that it was offensive to people more than a mile away.

Analysis showed that the gear teeth were coming into mesh at the rate of 29,240 times per min. Vibration at this rate produces a note almost an octave higher than middle C on the piano. The fan was metallically connected to



the steel walls of the cooling tower which acted like a huge loud speaker, amplifying the vibration into a loud noise. The trouble was corrected by supporting the motor and gear on rubber and metal mountings as shown in the figure.

The design of these mountings are such that they are loaded to obtain a deflection which will absorb 29,240 vibrations per minute without resonating at the motor speed of 1720 rpm or the fan speed of 384 rpm. The mountings are practically 100% effective in eliminating the noise and are made so that, even if the rubber were destroyed by fire or otherwise injured, the motor and gear cannot pull loose.

New York, N. Y. WALTER C KEYS
U. S. Rubber Products, Inc

Are You Prepared?

OFTEN, considerable savings can be made by rearranging plant-service systems to meet present requirements. Working conditions may become very different and it is not unusual to find serious overloads in some places and costly duplications in others.

In a recent case, there were four distinct steam-piping systems, each operated at a different pressure. Steam was kept on these 24 hours a day, 7 days a week because of the need of steam in a few small dry cabinets, one of which was connected to each system.

A study showed that only two of these dry cabinets required a continuous steam supply and that all of the equipment could just as well operate at a single pressure, except a few machines which were already equipped with individual reducing valves. A little rearrangement of the piping made it possible to connect the two dry cabinets to a small, well insulated line, and all of the other equipment to one of the existing lines, thus eliminating several hundred feet of unnecessary piping which was in poor condition. Steam was then supplied to the larger line only during working hours, while the small line was kept on all the time. These changes showed a saving of about half a ton of coal a day; total cost of the alterations was less than $100.

Studies and plans should be made at once and a definite program laid out and put into operation as soon as possible, for there is no doubt that those best prepared will be able to profit most by the business upswing.

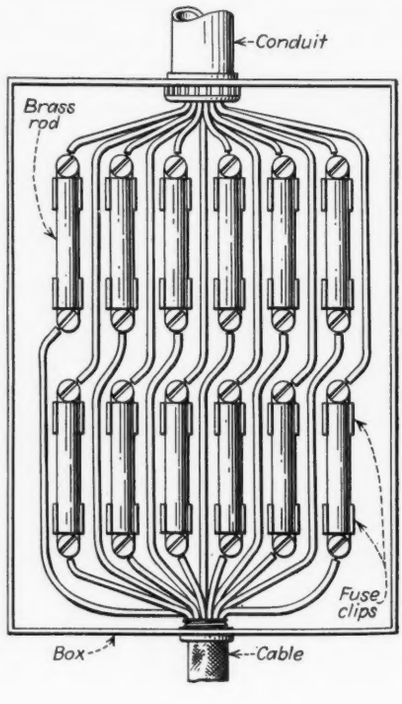
Hamden, Conn. W W GAYLORD
Consulting Engineer

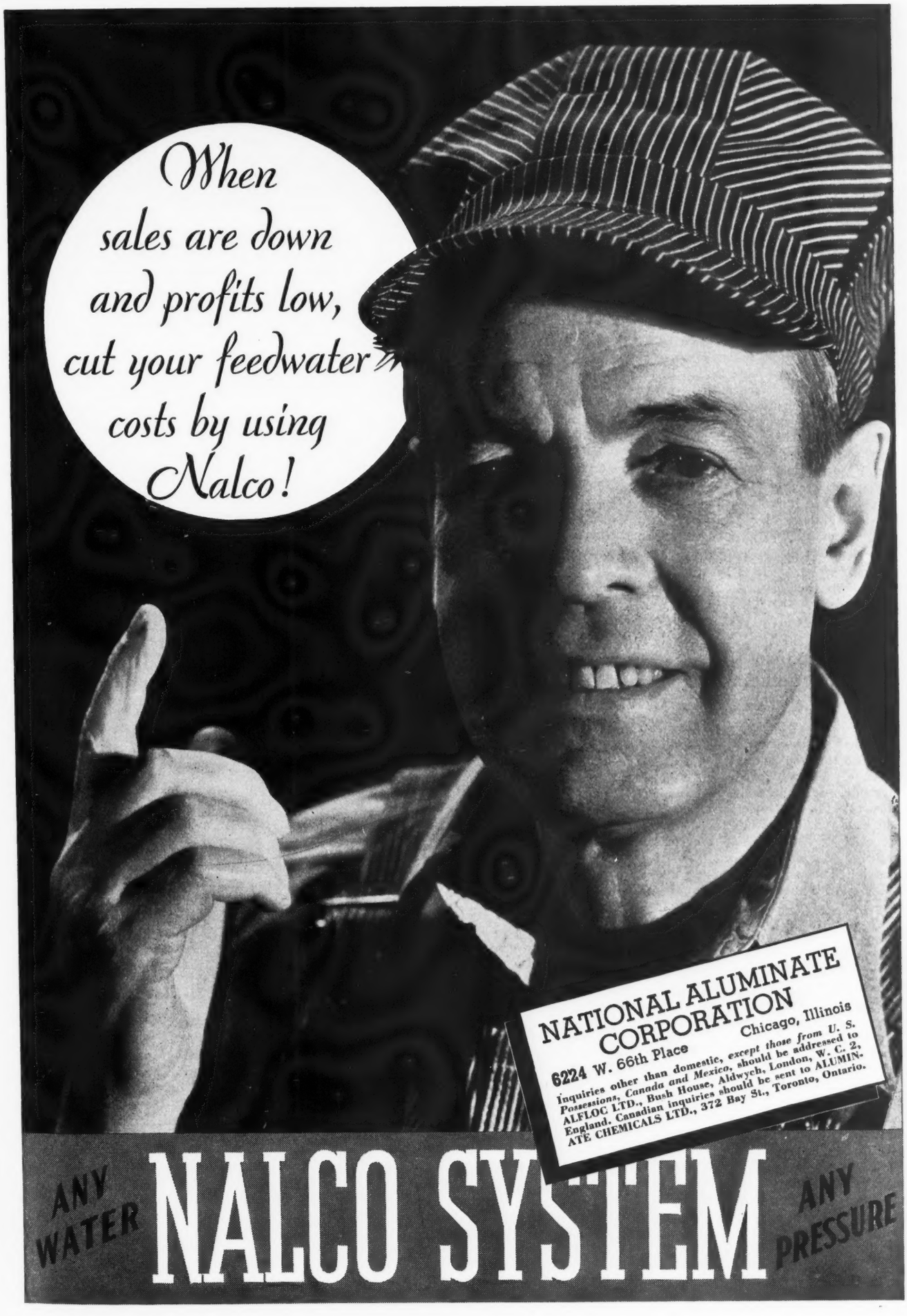
Fuse Clips Simplify Circuit Testing

TO SIMPLIFY and make easier the testing of control circuits, terminal junction boxes may be equipped with fuse clips instead of terminal posts. Sections of brass rod of the proper diameter and length are used in the clips to complete the circuits, as in the figure.

When testing, it is necessary only to remove rod sections to isolate the circuits, which eliminates the necessity of disconnecting wires from terminal posts. Of course, the line switch should be opened while working on equipment.

Baltimore, Md. THOMAS TRAIL




When sales are down and profits low, cut your feedwater costs by using Nalco!
NATIONAL ALUMINATE CORPORATION
6224 W. 66th Place Chicago, Illinois
Inquiries other than domestic, except those from U. S. Possessions, Canada and Mexico, should be addressed to ALFLOC LTD., Bush House, Aldwych, London, W. C. 2, England. Canadian inquiries should be sent to ALUMINATE CHEMICALS LTD., 372 Bay St., Toronto, Ontario.
ANY WATER
NALCO SYSTEM
ANY PRESSURE

Current Comment

Considers Wrench Kink Bad Practice

MY ATTENTION was drawn to the article "One Wrench Aids the Other," May *Power*. We are always interested in short cuts and kinks of this nature, but sometimes something comes up in these kinks that might well be left out. While Mr. Rogers may find his kink useful to himself, the suggestion which he makes is not good practice, not only because of placing undue strain on the wrenches, but also because there is considerable danger.

I think that practically all wrench manufacturers would back me up in the statement that any wrench that showed indication of being used in the way suggested by Mr Rogers, would immediately lose all standing as far as guarantee is concerned. If the user following Mr Rogers' suggestions gets by without breaking or damaging the wrench, he is very apt to find himself with some nasty cuts, bad bruises, and possibly broken bones, especially if the suggestion in Fig. 1 is practiced.

Allentown, Pa. S R ROBINSON
Bonney Forge & Tool Works

Burner Performance and Fuel-Oil Specifications

IN HIS article "Pointers on Oil Burners," March *Power*, C C Herman states that there are about 350 types of burners on the market requiring a number of different grades of oil for their successful operation. If he includes all the domestic burners, and "what have you," his estimate is no doubt quite conservative. When we confine ourselves to those which are suitable for industrial boilers, I think that about 10% of that number would be nearer the mark.

With burners of this class, generally speaking, the only grade of oil which should be considered from the standpoint of economical steam production, is that classed as No. 6, often referred to as "Bunker C". There are a number of burners on the market which will handle this grade with entire satisfaction, providing of course, that they are properly installed and operated.

Mr Herman is quite correct in stating that oil specifications are well established. If we refer to the API specification for No. 6 oil, however, we will see that they are not very definite, the most important qualification being that of viscosity, which may be anything from 100 to 300 S S Furol. In practice this means that anything which does not come within specifications for No. 5 or lower, can be sold for No. 6.

No. 6 is a byproduct, and priced accordingly. This is as it should be. Although a salesman may, in perfectly good faith, say that the oil which he is supplying, has certain characteristics, it will probably be impossible to get any oil company to sign a contract guaranteeing anything not covered by the API specifications. With the right kind of burners, this is really no detriment.

For No. 6 oil we generally have a choice between a steam-atomizing and mechanical-pressure burner. The rotary-cup type is sometimes sold for operation with No. 6 oil, but if viscosity is high, it may give trouble, because it does not handle high-temperature oil very successfully.

To insure good atomization, viscosity of the oil at a mechanical-burner tip should be about 300 S S U and for a steam atomizer, from 150 to 180 S S U. To obtain this, it may be necessary to heat No. 6 oil to a temperature of from 150 to 190 F for steam atomizers, and from 185 to 230 F for mechanical burners, depending upon normal viscosity of the oil. This of course applies only to No. 6 oil. When a burner is installed which will not handle oil at these temperatures, the oil is often blamed, and a more expensive oil with a lower normal viscosity recommended.

When installing an oil-burning system for industrial boilers, using the most economical grade of oil, I would strongly recommend that equipment be chosen to handle any No. 6 oil. Also that reliance be placed upon known operating performance of the oil-burning equipment, rather than upon qualities of the oil, which cannot be guaranteed under the standard specifications.

Bloomfield, N. J. J O G GIBBONS

Foaming and Carryover

WHAT *is the cause of boiler-water foaming and carryover. Does the cause lie, as I suppose, in the magnesium salts or their precipitates? What reagents are used for internal boiler treatment to prevent foaming or priming of water?*
—S A D

[*The foregoing question was submitted by* POWER *to W J Ryan, Water Service Laboratories, New York, N. Y. His reply follows*—ED.]

FOAMING of boiler water is caused by substances which stabilize the bubble formations. These are oil or other organic matter, or a high concentration of dissolved and suspended mineral salts. Such salts are present in every natural water, and may also be introduced to the boilers by the feedwater treatment.

Remedies for foaming are as follows:

1. The concentration of dissolved and suspended matter in the boilers can be decreased by increasing the blowdown. Boiler water should be sampled frequently and its density tested. A suitable hydrometer can be used, or the density of the water can be observed from its electric conductivity, for the measurement of which apparatus is obtainable. Or, chemical analysis can be used to ascertain the amounts of the principal ingredients dissolved in the water.

2. If oil or an excessive amount of organic matter is present in the feedwater, and it is not possible to eliminate the source of contamination, these impurities can be removed by coagulation and filtration.

3. If a large amount of make-up water is required, and the water has a high hardness, some form of external treatment may be necessary to avoid foaming and other operating troubles. If the hardness consists largely of bicarbonates of calcium and magnesium, the hot-process lime-soda treatment will not only soften the water, but will decrease the amount of dissolved solids entering the boilers. Or zeolite softeners or evaporators might be the best treatment, the choice depending on the amount of make-up water involved, its composition, and on local plant conditions.

4. If internal treatment is used, frequent tests or analyses of the boiler water should be made to regulate the blowdown and thereby limit the concentration of dissolved matter. The analyses will also show if the proper amount of treating material is being used.

5. A coagulating material can be used with internal treatment. An effective compound is made by one of the large American manufacturers of power-plant equipment, and consists of a dispersion of metallic iron in iron oxide. With waters of high magnesium content, sodium aluminate works well.

6. Anti-foam compounds containing castor oil are effective in checking foaming, but rather than rely altogether on them, it is better to try to remove the cause of the foaming.

7. It is helpful to carry a low water line, and avoid rapid opening of large steam valves.

Steam-Engine Power

AN OPERATING man's viewpoint may serve to amplify the timely discussion "The Steam Engine in Power Generation", May *Power*. The source of power has an important bearing on selection of auxiliary drives. In general, where current is purchased, engines and turbine drives are cheaper to operate if the exhaust steam can be efficiently utilized. With local generation, on the other hand, the lower steam rate of the main prime movers usually makes motor drives more economical. This is particularly true where boiler feedwater is heated by bled steam, although steam drives are often used at a slight sacrifice in economy because of their adaptability to variable

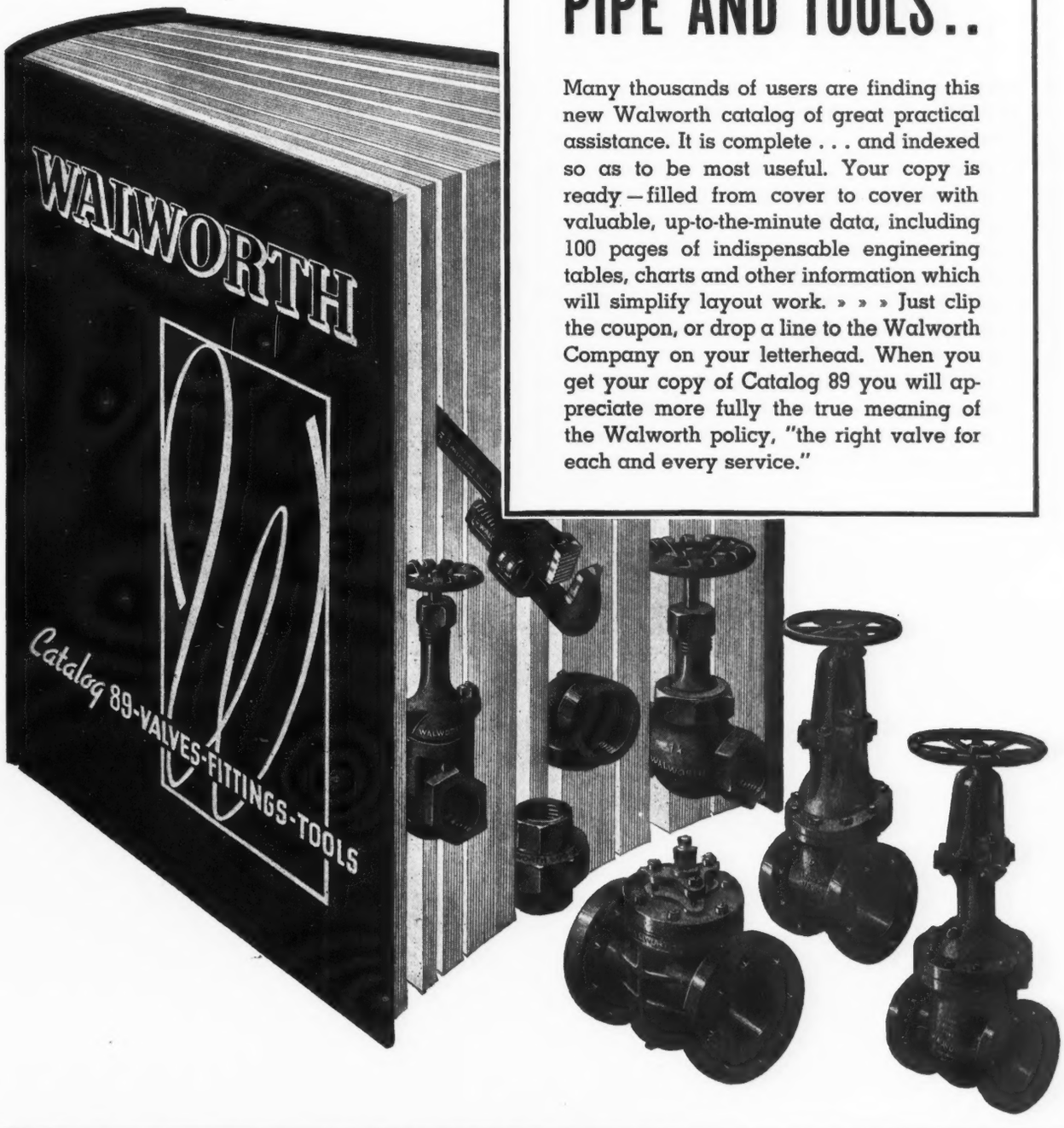
(*Continued on page* 110)

ADVERTISING PAGES REMOVED

Complete data . . . . AT YOUR FINGER-TIPS ON . .

VALVES, FITTINGS, PIPE AND TOOLS..

Many thousands of users are finding this new Walworth catalog of great practical assistance. It is complete . . . and indexed so as to be most useful. Your copy is ready—filled from cover to cover with valuable, up-to-the-minute data, including 100 pages of indispensable engineering tables, charts and other information which will simplify layout work. » » » Just clip the coupon, or drop a line to the Walworth Company on your letterhead. When you get your copy of Catalog 89 you will appreciate more fully the true meaning of the Walworth policy, "the right valve for each and every service."



WALWORTH

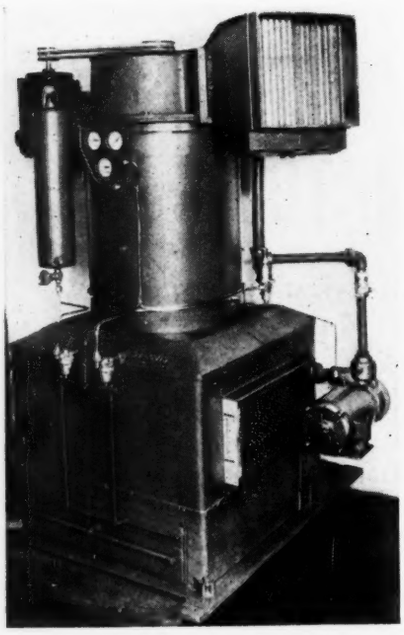
VALVES FITTINGS and TOOLS
Backed by 96 Years' Service

WALWORTH COMPANY
60 EAST 42nd STREET, NEW YORK

DISTRIBUTORS IN PRINCIPAL CITIES THROUGHOUT THE WORLD

WALWORTH COMPANY,
60 East 42nd Street, New York, N. Y.
Gentlemen:
Please send me my copy of the new WALWORTH Catalog 89.
Name ..... *Position* .....
Company .....
Address .....
City ..... *State* .....

What's New in Plant Equipment



Evaporative Condenser

EVAPORATIVE condenser-receiver designed for methyl chloride or Freon-12 (but can be furnished for other refrigerant vapors on application). Uses water cooling produced by evaporation of water on warm wetted surface. Water vapor is carried away by air current from built-in blower. Unit is constructed of heavy-gage steel sheet and has multiple vertical tubes. Water is drawn from lower pan to condenser top where a film of water flows by gravity down inside walls of tubes. Air is drawn by blower through filters and up through tubes in direction opposite to water flow and discharges saturated air over an eliminator core, removing free water which is returned to pan. Refrigerant is condensed on outside of tube and water is evaporated on inside. Water evaporation is approximately 1½ gal. per hr per ton of refrigeration.

Curtis Refrigerating Machine Co, St Louis, Mo.

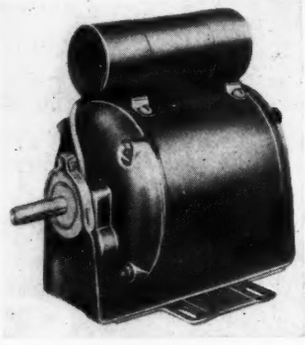
Ignition Lag Indicator

THIS instrument determines ignition quality (cetane number) of diesel fuels. Inherent accuracy is said to be greater than ¼ cetane number. Fuel is injected at a given time before top center, and compression ratio is adjusted to give ignition at top center, as measured by indicator. Fuel of unknown ignition quality is bracketed between two known fuels. Apparatus consists of magnetic pickups for detecting injection and ignition impulses, a double thyratron relay for converting these impulses into short-lived surges of electricity, and a neon projector mounted on flywheel and bearing two neon lamps (set at a known angular distance from each other) to convert impulses into a visual signal. Bulletin 1090-PO.

American Instrument Co, 8010-20 Georgia Ave, Silver Spring, Md.

Double-Capacitor Motor

HIGH-TORQUE, double-capacitor motor is addition to line of single-phase motors. Designated as Type RZN when equipped with rigid mountings and Type RZNR with annular resilient mountings. Made for 110/220 volts, in ⅓, ½, ¾ and 1 hp ratings. Has two capacitors of different value—a high value of capacitance for starting and a low value for running.

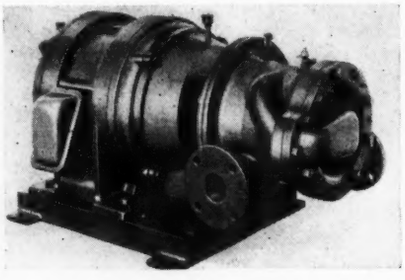


Change in capacitance occurs at approximately 75% full-load speed through a centrifugal switch on the motor. For humidifiers, stokers, refrigerant compressors, etc, where high starting torque, constant speed, quiet operation and long-hour performance are required.

Wagner Electric Corp, 6400 Plymouth Ave, St Louis, Mo.

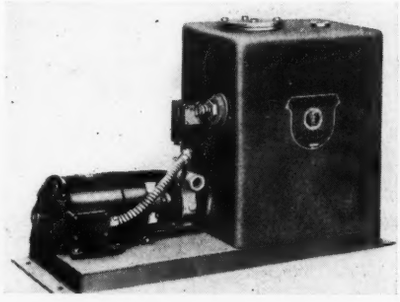
Centrifugal Pump

SUPPLEMENTING line of single-stage "SSUnit" pumps, this 2½x1½ in. 2-stage pump is good for heads up to 525 ft at 3350 rpm. It has an efficient capacity range of from 50 to 100 gpm against heads of 300 to 500 ft. Is bolted to motor frame by splash-proof connection piece, impellers being mounted on special motor-shaft extension. Pump is



made with standard squirrel-cage motors of from 10 to 30 hp, splash-proof or explosion-proof. Bulletin 2314.

Allis-Chalmers Mfg Co, Milwaukee, Wis.



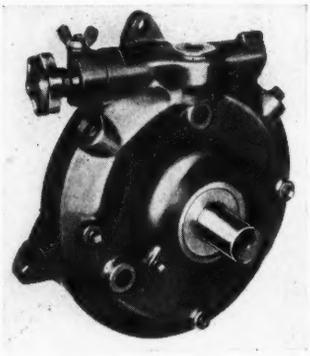
Condensation Pump

CLOSE-COUPLED "Hot Shot" condensation pump has Yoemans "Motopump" operating unit with balanced bronze impeller mounted on rust-proof steel motor shaft. Receiver is welded copper-bearing steel. Float switch, with cadmium-plated brass float and working parts, operates through a stuffing box 4 in. wide. Switch is mounted on a screw-in connection through which whole mechanism can be removed. Entire unit comes ready for pipe and electrical connections. Range of capacities of 1½ to 25 gpm.

Yeomans Bros Co, 1433 Dayton St, Chicago, Ill.

Variable-Speed Control

CONTROL unit governs speed of output shafts through an infinite number of variations through range of unit. With input shaft operating at recommended speed of 180 rpm, variable-speed control can be adjusted by hand set with visible

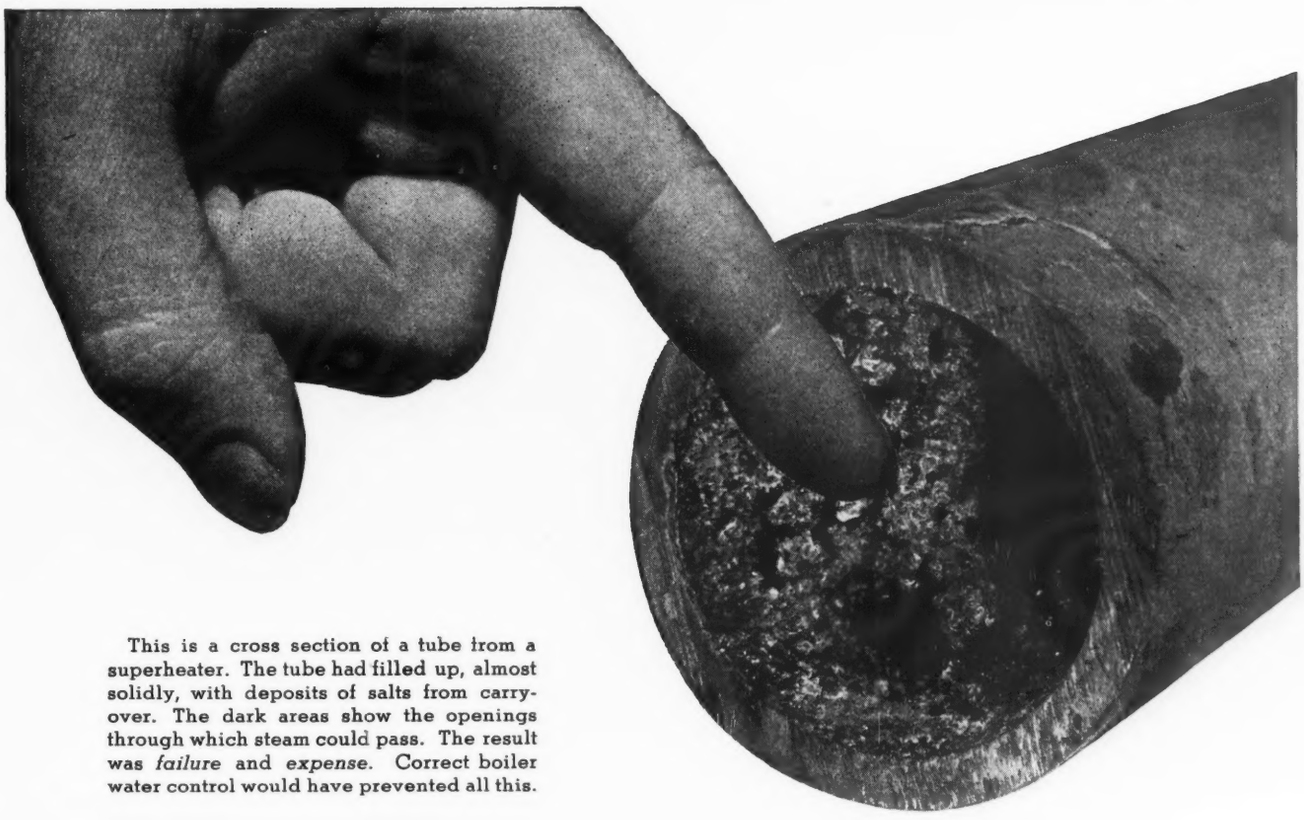


dial to deliver from 1½ rpm to 40 rpm through low-speed shaft. Unit is self contained and easily installed—it couples to shaft and bolts to machine frame by three bolts.

Morse Chain Co, Ithaca, N. Y.

Tachometer

HIGH-SPEED tachometer has speed range up to 100,000 rpm. Operates on chronometric principles, incorporating a Swiss precision watch movement. To stand high speed, spindle runs in two special ball bearings, so that a number of tests



This is a cross section of a tube from a superheater. The tube had filled up, almost solidly, with deposits of salts from carry-over. The dark areas show the openings through which steam could pass. The result was *failure* and *expense*. Correct boiler water control would have prevented all this.

CARRY-OVER DID THIS . . .

. . . correct boiler water control would have prevented it!

When boiler water carries over with steam, superheaters frequently plug up like this.

Hundreds of plants have learned by experience that carry-over is very expensive. It is a sure way to outage, with all the attendant costs for repairs and delays.

Correct boiler water control prevents all this!

Thousands of plants—large and small—everywhere, are being protected against carry-over by Hall Laboratories methods. You, too, can be definitely assured of full and maximum protection against boiler water evils in your plant when you use Buromin and Hall Laboratories water conditioning services.

Investigate this protection. Without obligation, we will be glad to study your problems of boiler water control and give you our recommendations.

THE BUROMIN COMPANY, 300 Ross Street, PITTSBURGH, PA.

BUROMIN

Carry-over is only one of the evils that develop in boilers. Other evils that are costly or destructive are pitting, embrittling and scale. The Buromin Company corrects and eliminates all of these evils with equal thoroughness.

THE BUROMIN COMPANY
300 Ross St., Pittsburgh, Pa.

Gentlemen:

We understand that, without obligation, you will make a study of our boiler water and give us your recommendations that may mean worth while savings.

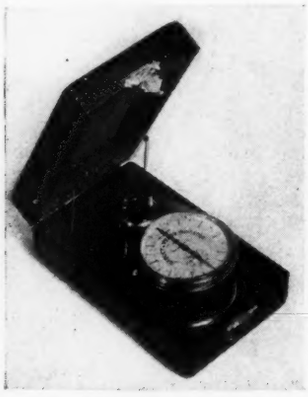
Name.....

Position..... Company.....

Address.....

City..... State.....

may be made successively without overheating bearings. Initial speed of spindle is reduced through small robust gear to normal so that measuring mechanism is operating at normal. One revolution of large hand, which represents

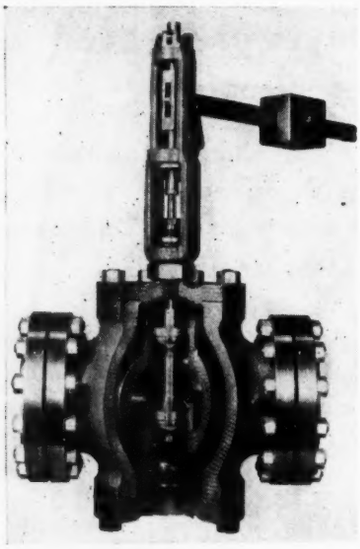


10,000 rpm, is subdivided in 100 rpm. A tell-tale hand counts up to ten turns of large hand, thus indicating from 10,000 to 100,000.

George Scherr Co, 128 Lafayette St, New York, N. Y.

Balanced-Lever Valve

SERIES 42 balanced lever valve is for steam, air, water and most gases. In Type 42-R valve illustrated, roller-guided top insures free valve movement, valve-stem alignment, etc. Double or single

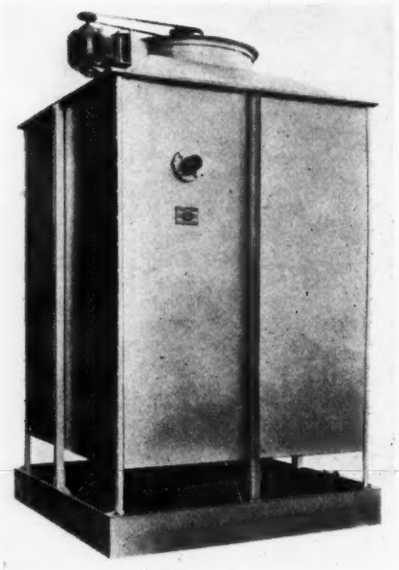


seat. Any type inner valve: parabolic, flat with bevel seat, V-port with bevel seat, and V-port, non seating. Made in any capacity, any materials, ½ to 3 in. screwed ends; 1 to 12 in. flanged ends. Bulletins No. 963 and 965.

A W Cash Co, Decatur, Ill.

Cooling Towers

ADDITION to line of water-cooling equipment is a series of small steel-cased induced-draft cooling towers, including horizontal wood-filled types for indoors and vertical wood-filled or spray-filled



types for outdoor service. Horizontal indoor towers range from 2½ ft x 7½ ft x 3 ft, 2½ in. to 2½ ft x 8½ ft x 6 ft, 8½ in. Casings and basins are 16-gage copper-bearing steel. Zig-zag drift eliminators of heart redwood and cast-iron spacers are built as one unit, easily lifted out for access to tower interior. Vertical outdoor towers, made in 12 sizes, have multiple-effect drift eliminators of heart redwood with cast-iron spacers and Marley fans V-belt driven from motors mounted on tower roofs. For cooling condenser and compressor circulating water, diesel jacket water, etc. Unit illustrated is vertical outdoor type.

The Marley Co, 3001 Fairfax Rd, Kansas City, Kan.

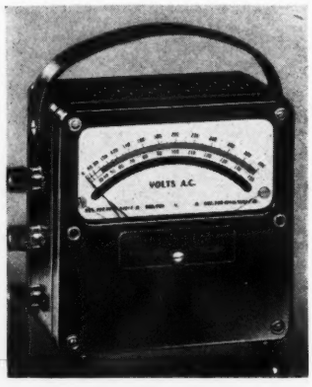
Telephone System

FOR three or four phones up to several hundred. No batteries or other power source is needed to operate speaking circuit. Sole source of power lies in vibrations of speaker's voice. These actuate diaphragm of telephone, which, in moving, creates voice current which travels over wire to receiving telephone, where it is converted back into original vocal tones. System has been used over several hundred miles. Although no outside source of power is required for speaking circuit, dry cell or some other power source is needed for bell or buzzer calling.

Telephone Systems Co, 120 Greenwich St, New York, N. Y.

Temperature-Compensated Multi-Range Voltmeters

PORTABLE multi-range Model 433 ac voltmeters have improved temperature compensation. Double range instruments (300/150 volts and triple-range (600/300/150 volts) are made with improved compensation which holds temperature errors to 1% for 60 C on both 250-volt and 300-volt ranges and to 1% for 240 C on 600-volt range. Due to special internal connections, switches are used for range changing. Switch for double-range instrument is a double-pole, double-throw toggle; that for triple-



range type is a double-pole, 3-position rotary switch.

Weston Electrical Instrument Corp, Newark, N. J.

Salt-Tablet Dispenser

IMPROVED salt-tablet dispenser is compact all-metal cylinder fitted with convenient wall bracket for mounting at drinking fountains. Alumilite, a special corrosive-free metal, guards against chemical reaction between salt and metal. To secure a 10 or 15 grain salt

tablet, worker flips small lever at base of dispenser. Intended as an aid in reducing effects of heat fag by protecting against loss of body salt through sweating.

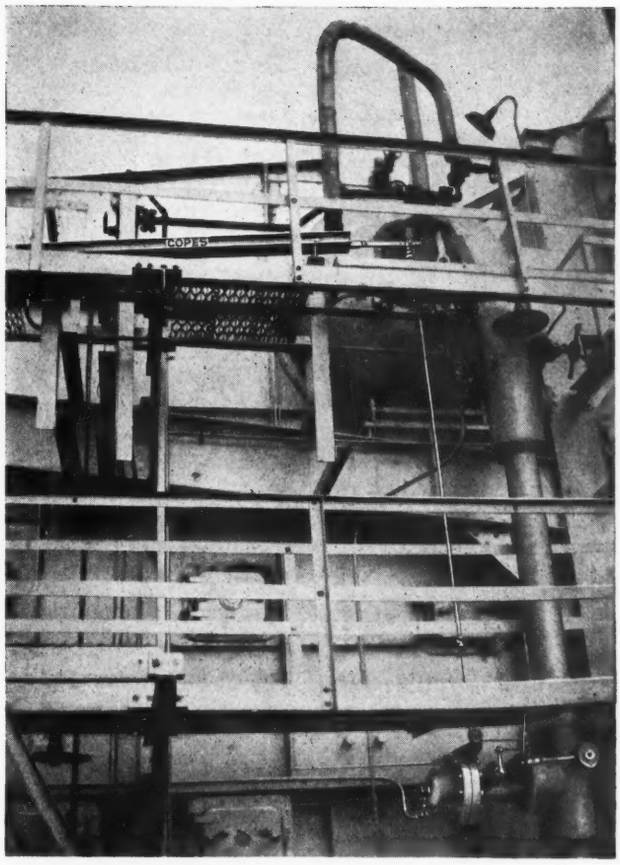
Morton Salt Co, Chicago, Ill.

Indoor Current Transformer

TYPE JW 1, 5000-volt indoor current transformer replaces model WF-12. Accuracy of new JW-1 conforms to NEMA rating of ¼X, ¼Y, and ¼Z at 60 cycles. Formed fibre caps cover end of core, obtaining high flashover value

At Fort Bend Utilities Company

This all-outdoor Riley Steam Generator carries a combined utility and sugar plant load. The steam demand fluctuates rapidly and over a wide range. The COPES Flowmatic Regulator, shown in the photograph, was installed and adjusted without need of factory service. There is an extreme water level variation of plus or minus one inch.



Write for this Interesting Paper

We have just published an 8 page paper about the Fort Bend plant. It describes the major equipment, analyzes the steam demands and discusses results obtained with the new COPES Flowmatic Regulator. It is illustrated with photographs, charts and diagrams. Write today for a copy of this interesting paper—on your letterhead, please.

Fort Bend knows the value of the Flowmatic

Easy installation, simple adjustment, trouble-free operation with only routine attention, close boiler water level control on the most rapidly swinging loads. These are the reasons why the new Flowmatic made good at Fort Bend—why it will make good on your fast-steaming generators.

NORTHERN EQUIPMENT CO., 711 GROVE DRIVE, ERIE, PA.

Feed Water Regulators, Pump Governors, Differential Valves
Liquid Level Controls, Reducing Valves and Desuperheaters

BRANCH PLANTS IN CANADA, ENGLAND, FRANCE, GERMANY, AUSTRIA AND ITALY . . . . REPRESENTATIVES EVERYWHERE

Get closer boiler water level control with the new

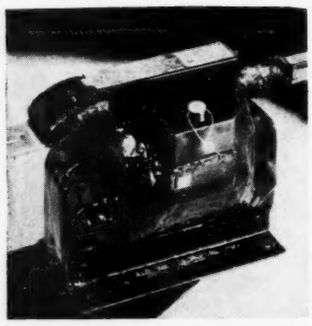
COPES

FEEDS BOILER ACCORDING TO STEAM FLOW•AUTOMATICALLY

FLOWMATIC

★ REGULATOR

without increasing dimensions. Sufficient space is provided for taping primary terminals with an anchoring overlap on transformer insulation. Secondary short-circuiting switch is designed to afford positive and visible

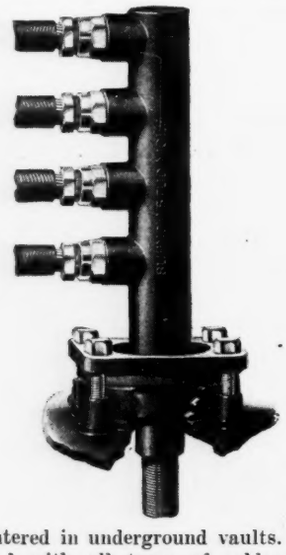


contact. All internal connections, both primary and secondary, are copper brazed.

General Electric Co, Schenectady.

Stud Mole

TYPE ZMLD stud mole is a combined insulated multiple terminal and bushing for network protectors used in underground distribution. Is designed to provide multiple connections in small space and to seal out moisture and gas



encountered in underground vaults. Can be used with all types of cables, and for making multiple terminal connections on distribution transformers.

Burndy Engrg Co, 459 E 133rd St, New York, N. Y.

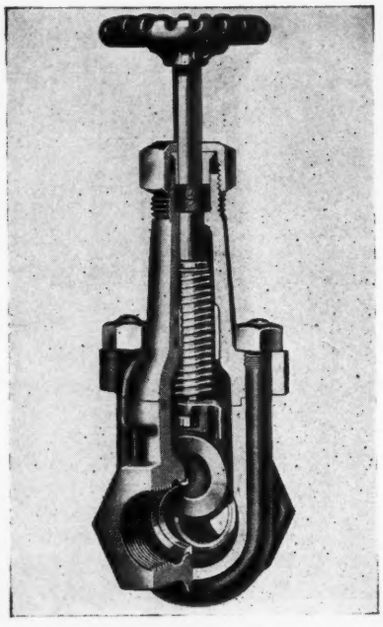
Circuit Breaker

"DULBRAK" circuit breaker for 125 volts ac or dc in capacities from 6 to 50 amp has a bi-metallic thermal breaker. Is trip free, non-closeable on short circuit or heavy overloads. Incorporates positive double-break contacts with low-arcing, quick-make and break action. When a circuit is automatically interrupted, red-dot signal button pushes out beyond face of unit and handle remains at *ON* position.

Frank Adam Electric Co, St Louis, Mo.

Gate Valves

U-BOLT gate valves for 150 lb steam working pressure, 225 lb gas and liquid pressure, has body and bonnet of chrome-nickel alloy iron or semi-steel with average tensile strength of 40,000 lb per sq in. Relief slots in threaded bonnet bushing permit drainage back into body chamber, eliminating possibility of

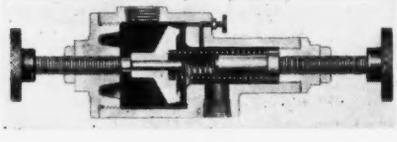


clogging above bonnet threads. Protected top seat above stem threads makes tight joint with large seat under stuffing box. Valve can be repacked under pressure when fully open without leakage.

The Fairbanks Co, 397 Lafayette St, New York, N. Y.

Shutoff Valve

AUTOMATIC shutoff valve is placed in supply line above flexible hose used to convey compressed air, steam, gas or fluids under pressure. Valve operates on



principle of equalization—that as long as pressure at inlet and outlet are nearly equal, or exactly same, plunger is maintained in an open position by a spring, permitting steam, air, etc, to flow around it in a normal manner. Plunger may be adjusted to shut off automatically flow at any desired pressure at inlet, or size of break at or below outlet.

D J Murray Mfg Co, Wausau, Wis.

Air Cleaner

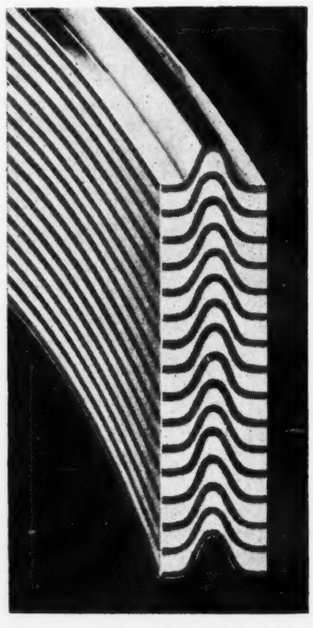
"LINCONDITIONER", an air cleaner for grinding, welding, etc, consists of a motor-driven fan which produces suction through flexible metal tube. Fan draws air through flexible tube and exhausts it

into a filter in periphery of power unit. Flexible tube is supported by welded-steel arm, so that nozzle can be shifted to any desired spot. Illustration shows unit being used in welding of copper to carry smoke and dirt particles away from operator.

Lincoln Electric Co, Cleveland, Ohio.

Gasket

SPIRALLY wound metal-asbestos gasket retains maximum resiliency for long periods. Ruggedness of "Flexiwound" gasket said to give long life. In many,



or perhaps most services, it may be used a number of times with safety. A general purpose gasket, for all special or standard flanges, boiler-tube caps, handholes and manholes.

Azor Corporation, Newark, N. J.

Air Conditioner

SELF-CONTAINED, packaged air conditioner made in 3-ton and 5-ton sizes. Water-cooled units require three connections for installation. 3-ton unit delivers 1100 cfm of air and 5-ton unit, 1460. Dynamically balanced compressor; selector and thermostat dials on cabinet front at eye level for both manual and

PROOF THAT RING-FREE *reduces cost per K.W. hour* BY REDUCING FRICTION

CITY OF WINDOM
OFFICE OF CITY CLERK
WINDOM, MINNESOTA

Jan. 20th, 1938

I. Miller & Co.
Sioux City, Ia.

Gentlemen:

You will be interested to know of our experience with Macmillan Ring-Free Oil in our light plant engines here in Windom, Minn.

We have here two Busch-Sulzer 375 hp. four cycle Diesel engines which were newly purchased about a year ago. We had been using a very popular nationally known diesel oil and had experienced difficulty keeping the temperature of the oil in the engines down to where we could maintain the pressure on our oil gauges.

We called on the factory representative of Busch-Sulzer and after every effort on his part to correct the trouble had failed, he advised us to install extra plumbing to turn the extremely cold city water into the coils in the oil cooler. This held our pressure up most of the time.

On Nov. 15th we purchased ten bbls. of Ring-Free oil from you and put it in one of the engines. The pressure ran entirely too high and we had to cut off the cold water in the coils of the oil cooler and the temperature of the oil still holds the pressure up.

This has proven to us that your oil has reduced the friction in this engine. Also our exhaust temperatures have dropped 40 degrees.

Over this period of 60 days our k.w. per gallon of fuel oil has increased an average of eight per cent. The engine also is running noticeably much smoother.

We consider this the finest lubricating oil we have ever used.

Respectfully,

J. J. Hiebert

Sup. Municipal Light Plant.

. . . IN BUSCH SULZERS

MACMILLAN
RING-FREE
MOTOR OIL

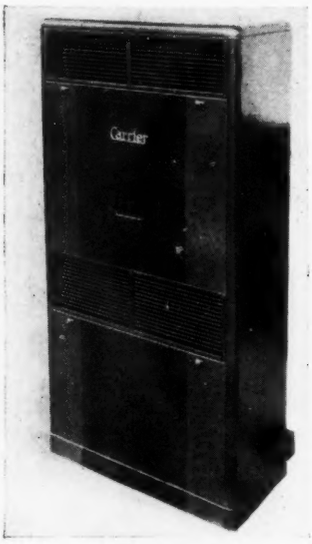
1. GREATER FILM STRENGTH
2. HIGHER HEAT RESISTANCE
3. LONGER CLING TO METAL
4. FASTER PENETRATION
5. REMOVES HARD CARBON
6. IS NOT CORROSIVE

Nothing need be added to the above letter except to explain *why* RING-FREE reduces friction so much more than other oils: RING-FREE has greater film strength, higher heat resistance, longer cling and greater penetration. That's *why* it lubricates better; that's *why* it reduces wear and repair bills . . . in every type of diesel, gasoline or natural gas motor. But here's *more* good news . . . it removes hard carbon formed by fuel or other oils!

There's a Macmillan Man near you . . . let him show you comparative tests between RING-FREE and any other oil you name.

MACMILLAN PETROLEUM CORPORATION

50 W. 50th St., New York ● 624 S. Michigan Ave., Chicago ● 530 W. 6th St., Los Angeles



automatic temperature regulation; controlled mixture of outside and room air by large-area return grille with adjustable louvres; and non-clogging refrigerant strainer.

Carrier Corp, Syracuse, N. Y.

Magnetic Valve

DUAL magnetic valve for hi-low fire or hi-low flow control has two electrically independent solenoids operating two lever-action, high-pressure valves. Will handle oils as heavy as No. 6 at usual

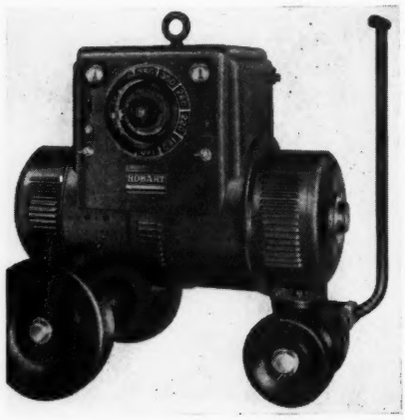
room temperature or steam up to 125 lb pressure up to 400 F. Flow adjustments are provided on both ports. Packless, normally closed; energy consumption is 14 watts per solenoid.

General Controls Co, 450 E Ohio St, Chicago, Ill.

Arc Welders

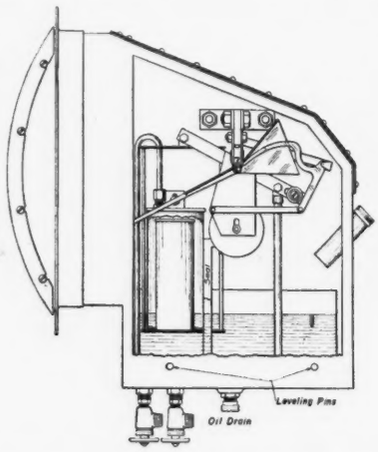
LINE of multi-range arc welders has same principles of control as previous models, but welding range is divided into ten ranges with a 100-step, continuously wound rheostat operating in each range. Welding ranges are selected by turning a large hand wheel on front of "Turret Top" control cabinet. Separate voltmeter and ammeter are also provided (optional with Junior models), flush mounted on front panel. Junior models have built-in electric motors in 100- and 150-amp ratings or self-starting gasoline engines in 200-amp rating. Senior models include 150-, 200-, 300-, 400- and 600-amp electric drive; 200-, 300- 400- and 600-amp gasoline-engine drive; and 200-, 300- and 400-amp generators for connection to customer's gasoline engine or electric motor.

Hobart Bros, Hobart Square, Troy, Ohio.



Air-Flow Gage

AIR-FLOW gage gives accurate measurement of air and gas across an orifice in cfm or cfh on a scale of equal divisions. Square-root movement consists of a pointer with camtrack in counter weight of pointer and a cam linked to gravity arm of power unit. Pointer is carried on knife-edge fulcrum bearings underneath fulcrum bearings of power unit. Pointer and track move through 50 deg, 25 above and 25 below horizontal. Power unit consists of gasometer bell, moving

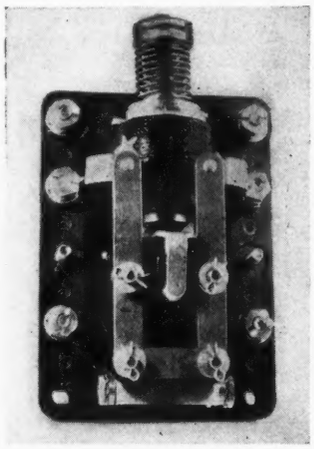


within stationary bell. Bell has a seal that prevents oil from being blown out of pan under pressure surges in excess of scale range.

Ellison Draft Gage Co, 21½ W Kinzie St, Chicago, Ill.

Overload Relay

OVERLOAD relay, for either ac or dc, has contacts rated 30 amp at 110 volts ac, 20 amp at 220 volts ac, 6 amp at 110 volts dc, and 3 amp at 230 volts dc on non-inductive loads. Is somewhat similar to line of mechanical latch-in electrical reset relays. Contacts can be opened manually or by voltage-operated coil. Latch is adjusted to pick up and open contacts when current in overload coil reaches proper value. This setting is



adjustable by knurled nut on top of relay over a range of 2 to 1.

Struthers Dunn Inc, 139 N Juniper St, Philadelphia, Pa.

Phone Booths

ACOUSTIC phone booths, for limited space and noisy locations, are made in two models. Model 301 is bolted

to wall or pillar; Model 401 rests on bench or desk. Special lining of perforated metal backed by soft sound absorbent prevents interference with telephone user.

Acoustic Div, Burgess Battery Co, Chicago, Ill.

Fire-Extinguisher Handwheel

IMPROVED handwheel of "Lux" fire extinguisher gives better grip, more leverage, and is easier to operate. Has a pull-out pin which is kept in tension at all times to assure positive sealing.

Walter Kidde & Co, 60 West St, Bloomfield, N. J.

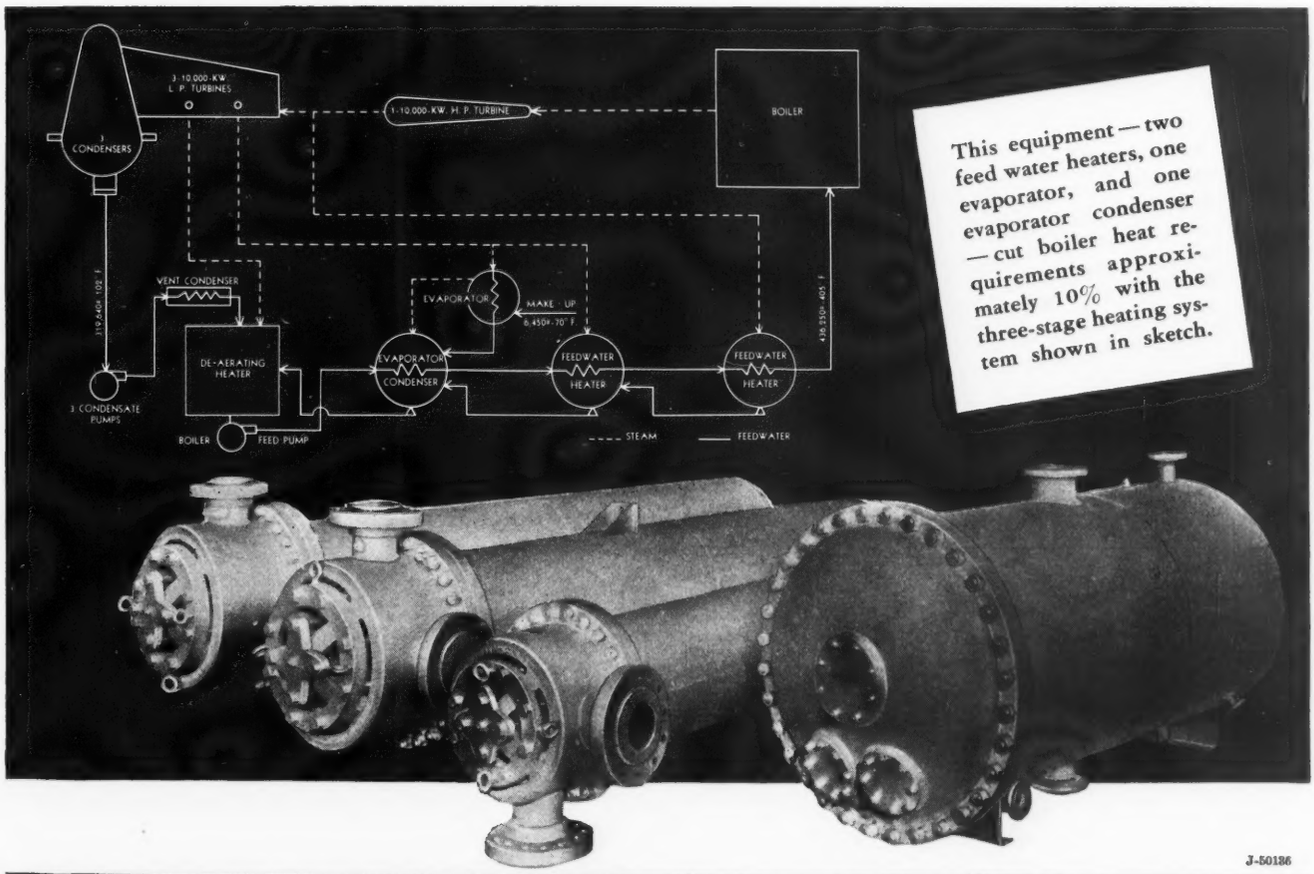
JUST LIKE FREE STEAM!

BTU'S SAVED IN FEED WATER HEATING *Cut* INDUSTRY'S POWER BILLS

The savings possibilities of staged feed water heating are well-known. And with today's conditions of higher steam pressures and temperatures, the possible savings are greatly increased.

BUT — how high should feed water temperatures be raised? — how balance between heat savings and equipment cost to effect the greatest net economies? The answer to these and other heat balance questions can be given — accurately, authoritatively — by Westinghouse steam engineers.

Submit your heat balance problem to steam headquarters. The Westinghouse line of closed feed water heaters and evaporators is complete, and backed by the most extensive steam research and service organization in the country. For full information, call your nearby Westinghouse office or write Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.



J-50186

WESTINGHOUSE ELECTRIC

Westinghouse *Complete* STEAM AND STOKER SERVICE

TURBINES · CONDENSERS · FEED WATER HEATERS · VACUUM EQUIPMENT · STOKERS

I CAN . . .

Somebody said it couldn't be done,
But he with a chuckle replied
That maybe it couldn't, but he would be one
Who wouldn't say so 'til he tried.

So he buckled right in with a trace of a grin
On his face. If he worried, he hid it.
He started to sing as he tackled the thing
That couldn't be done, and he did it.

—Edgar Guest

GENERAL GRANT is said to have explained his habit of winning battles by saying, "When in doubt, I always do *something.*" No chance there for the indecision that ruins morale and plays hob with efficiency. He knew that the man who marks time is really marching backwards.

In times like these, is it easy to accept the seal on the purse strings and to say, "I can't get any money to improve the plant, so I'll just sit tight until things loosen up."

But you can't sit tight! Unoiled bearings go right on wearing, unpainted pipes go right on rusting, and unrepaired equipment wears out at ten times the proper rate. And to fix any of these things takes only ingenuity and a very little cash—even the Boss who's buying red ink can understand that run-down equipment will cost him his shirt later on.

So fix what you can. Maybe you can't get major equipment, but get the minor parts and accessories you've been needing. Clean up and paint up. Refurbish and repair. And get together a comprehensive plan of just what you'll do—and what it will save—when money loosens up.

Tomorrow the Boss may say, "I'll need a thousand more horsepower after August first." Are you ready? If only a few Bosses say that, equipment manufacturers will be so busy that they can't accept orders delayed for belated planning. Prices will react accordingly; you will pay both in cost and in lost economy for your indecisiveness.

Don't let this temporary setback damp your spirits. Dig out of yourself some of what's in you, some of the heritage that we Americans call "guts." I still like the old slogan I saw in one boiler room, "The man who says it can't be done is pushed out of the way by somebody doing it. Remember that 'Amer-I-can' ends in 'I can.'"

George Edwards

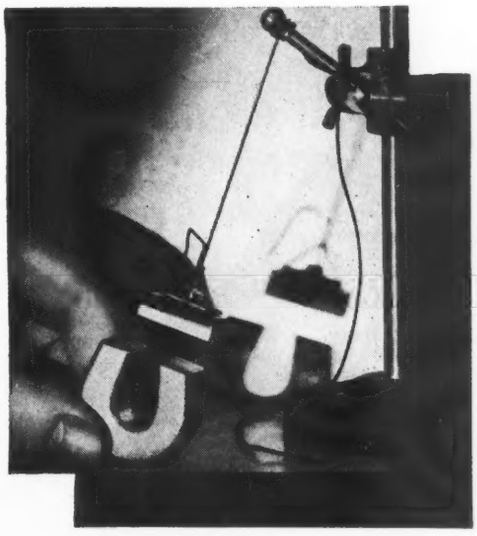
Engineer

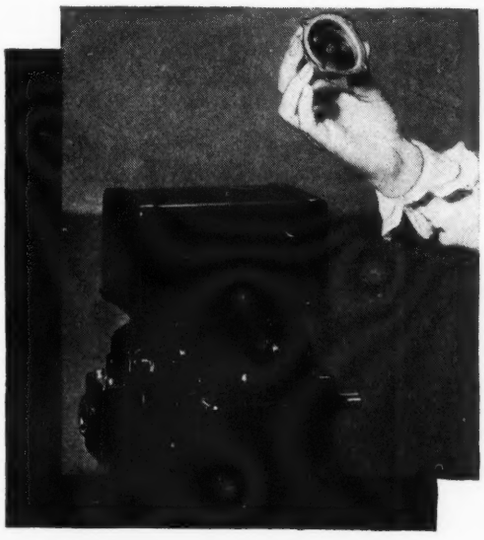
HIGH NICKEL ALLOYS

RAISE EFFICIENCY AND LOWER COSTS

...in scores of special applications

HIGH MAGNETIC QUALITIES... The magnet pictured here is small, but extraordinarily powerful—capable of lifting 60 times its own weight. This particular type, made of a new alloy rich in Nickel, is used for damping magnets in the polyphase meters of the Duncan Electric Co., Lafayette, Ind. Not only do these alloys of high Nickel content effect substantial savings in weight (in this case 80%) but they also have a higher permanency factor than other commercially available magnetic materials and are practically immune to the effects of magnetic disturbances caused by short circuits and lightning. Manufacturers who employ magnetic materials in their products will find these new alloys of Nickel profitable to investigate.





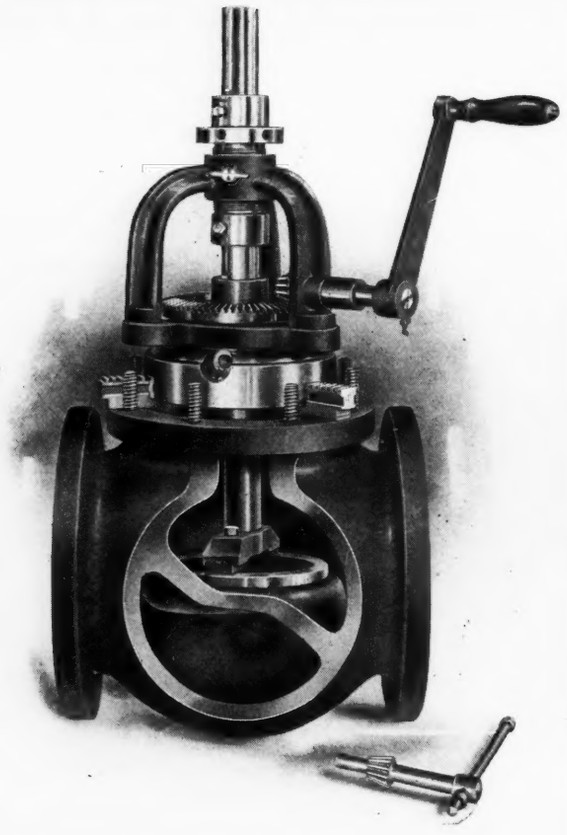
HIGH AND LOW EXPANSION PROPERTIES...

One of the most valuable metallurgical developments in recent years has been the production of thermostatic metals for operating automatic control devices. Pictured here is one employing a bi-metallic disc made of two alloys of Nickel, one having a high degree of expansion and the other low expansion properties. It guards the Westinghouse refrigerator motor, disconnecting it when it gets too hot and reconnecting it when it cools off. Principle upon which these thermostatic metals operate is based on a differential in the expansion properties of the two constituent metals. Changes in temperature cause them to deflect and this in turn acts on the control device. Alloys of Nickel can be produced for applications requiring extremely low expansions as well as for service where specific expansion characteristics may or may not be low.

IMPROVED PERMEABILITY... When you make your long distance telephone call or send a cable, a highly magnetic Nickel-Iron alloy of improved permeability containing up to 80% Nickel helps to deliver your message. Impulses sent over long circuits have a tendency to drag their "tails" behind them, upon which succeeding impulses tread. But through the use of loading coils made of a high Nickel alloy, and spaced at regular intervals along the circuit, transmission is speeded up and your words made intelligible. The high magnetic permeability of these alloys is also depended upon to increase the efficiency of submarine cables and various parts of radio, telephonic and telegraphic installations. We invite consultation on the use of the Nickel alloys in your equipment.

THE INTERNATIONAL NICKEL COMPANY, INC., NEW YORK, N.Y.

VALVE RESEATING MACHINES ARE NEEDED IN *EVERY* PLANT



12" Capacity Dexter Globe Valve Reseating Machine.

Every plant using valves needs a good valve reseating layout. A valve should be reseated as soon as found leaking. Delay costs money.

DEXTER VALVE RESEATING MACHINES

are made for reseating globe valves, gate valves, and for refacing pump valve seats.

As soon as the valve starts to leak use the Dexter Machine. In a few minutes the valve can be reseated and made tight.

The investment in a good valve reseating layout pays big dividends. In many cases one or two jobs have more than paid for the cost of the machine.

The machines are made in various capacities for small and large plants. No matter what the requirements, there is a Dexter Machine for them.

Write now for catalog—no obligation.

Also manufacturers of the Swendeman Automatic Separator which eliminates water and oil from compressed air

THE LEAVITT MACHINE CO.

10 East River St. Orange, Mass.

Current Comment

(*Continued from page* 96)

speed and control requirements.

Dependability must also be considered. Steam drives are ordinarily affected very slightly by moisture, atmospheric dust, and other external influences that would play havoc with motors. With purchased power, substitution of steam for electric drive will eliminate costly interruptions from power-service failure. If power is generated locally, essential auxiliaries should always be supplemented by steam-driven standbys to permit starting up even if main generating units are shut down.

Where steam-engine drives fit, their principal disadvantages are:

1. Greater weight for a given horsepower output, necessitating heavier foundations and erection of dismantling facilities. 2. More floor space and head room needed. 3. Safety devices must be carefully maintained to prevent destructive overspeeding, whereas motor speeds are fixed. 4. Guards must be placed around flywheels. Motors require no mechanical guarding.

5. Lubricating systems are more involved and require frequent attention. 6. Housekeeping is complicated by the area and complexity of surfaces to be cleaned. 7. Pipelines and valves require more maintenance than electrical branch circuits of motors. 8. Labor costs of both operation and maintenance considerably higher than with motors. 9. Efficiency falls off rapidly with wear of valve gear and cylinders. Motor efficiency remains practically constant.

10. Adjustment for greatest economy requires a degree of technical skill not ordinarily found in the small plant. 11. Radiation losses from connecting piping continue even though the engine is shut down. 12. In plants having a large number of motors, interchangeability of driving mediums is hampered and the necessary inventory of spare parts is increased by the installation of scattered steam engines having various dimensions and horsepower ratings.

Roanoke, Va. S H COLEMAN

Readers' Problems

(*Continued from page* 85)

placed outside the engine room, where the surrounding air was cooler. This stopped all complaints.

Nutley, N. J. THOMAS SHEEHAN

Drain Receiver

PP'S RECEIVER should be drained regularly; this might be done with one of those automatic water drains on the market. These do not allow oil or moisture to accumulate in the receiver.

No harmful effects have been observed from the use of compressed air for masks, at our plant. We have a filter for

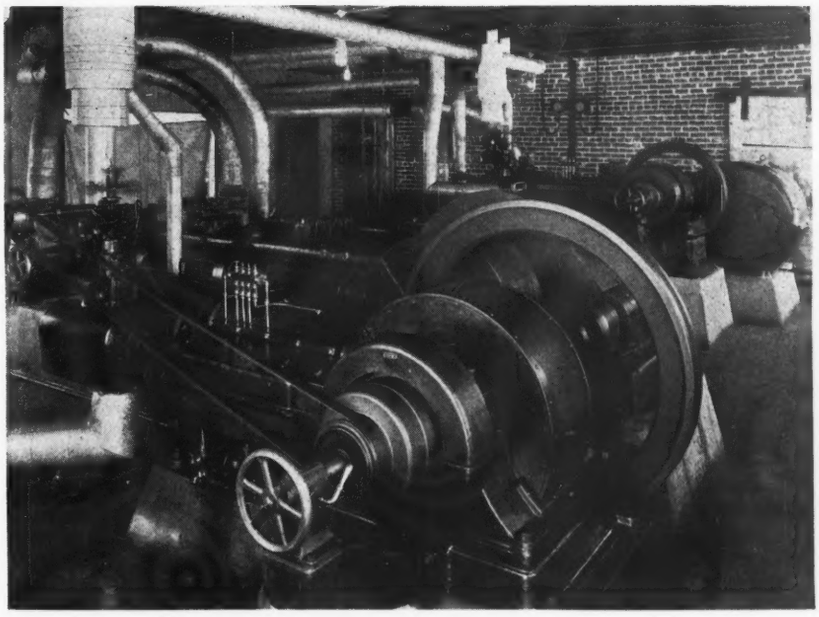
HERE'S *Genuine* LOW-COST POWER TYPICAL OF TROY-ENGBERG STEAM ENGINES

BLOWERS	0.308
STOKERS	0.775
REF. COMPS.	0.460
DRAFT FANS	0.459

CENTS PER KILOWATT HOUR WITH *all costs* INCLUDED

THESE are not isolated, hand-picked cases where due to exceptionally favorable conditions costs are at this unbelievably low level. They are the *average* costs of a score or more of Troy-Engberg Steam Engines selected at random from many.

Note that the figures include all costs—*every installation, operating and fixed charge.* Nothing was left out. Nor is this low cost Troy-Engberg power confined only to the four classes of auxiliaries noted above. Pumps (such as shown in the picture), mixers, dryers, exhausters, generators, line shafts, cookers . . . practically every class of auxiliary is in this low-cost power field.



Now is a good time to look into this question of the cost of driving auxiliaries. If you can save hundreds, possibly thousands, a year on each and every drive for which the modern steam engine is suitable, wouldn't it be worthwhile changing over? On new equipment there should be no question at all.

To get more details of the exceptionally low cost of driving auxiliaries, send for Survey Bulletin 101 as illustrated in the coupon. It tells how 43 Troy-Engberg Steam Engines average only ½ cent per kilowatt hour for driving 19 different classes of equipment.

TROY ENGINE AND MACHINE CO.

Established 1870

1440 Railroad Ave., Troy, Pa.

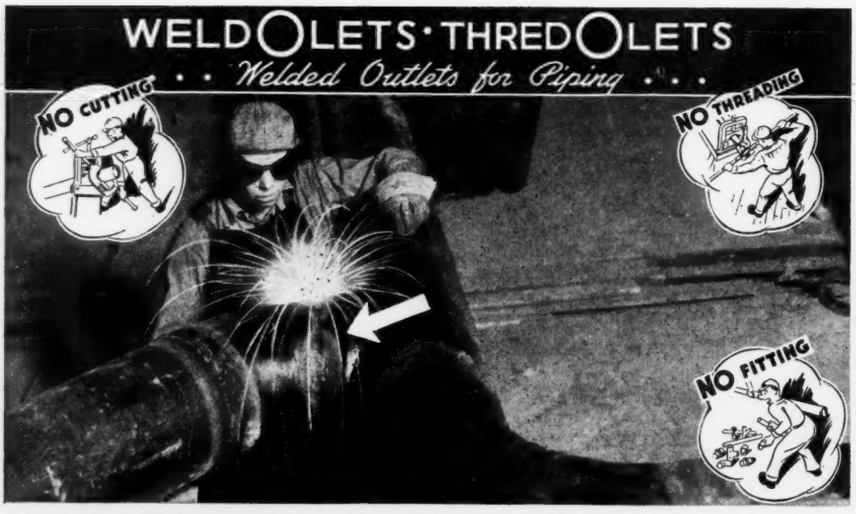
Troy Engine & Machine Co., 1440 Railroad Ave., Troy, Pa.

Gentlemen: Please send us a copy of Bulletin 101 which describes the results of the Survey referred to above.

Name & Title.....

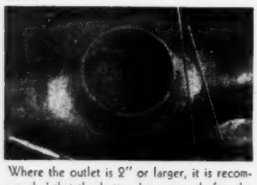
Company .....

Address .....



WeldOlets and ThredOlets are easily installed. Simply select the position of the outlet, rub the fitting over the pipe several times to remove scale, mark center lines and tack the WeldOlet or ThredOlet into position.

The WeldOlet or ThredOlet is then welded into place either by the electric-arc or oxy-acetylene method. A junction of full pipe strength and an outlet that is leak-proof is the result.



Where the outlet is 2" or larger, it is recommended that the button be removed after the welding operation. On small sizes, the fitting is used as a templet and the hole is cut in the main pipe first. A full inspection of the inside of the joint is possible by using these fittings, allowing removal of all scale, welding metal, etc.

The branch line is then welded into position using a simple Vee weld. In the event that a ThredOlet is used the branch pipe is threaded and screwed into place. The result is a junction of full pipe strength, absolutely leak-proof with turbulence and friction reduced to a minimum.

No Cutting - No Threading- No Fitting when WeldOlets and ThredOlets are used

No Cutting—No Threading—No Fitting of the main pipe is necessary when WeldOlets and ThredOlets are used. Branch connections made with these fittings are strong, permanent and absolutely leak-proof. Preliminary layouts of the main pipe and branch are unnecessary. No templetes are used.

Due to their funnel-shaped outlets, WeldOlets and ThredOlets provide free, unrestricted flow. Their heavy, external rib compensates for loss of strength in the main pipe when the hole is cut and distortion is entirely eliminated.

Available from stock with outlet sizes from ½" to 12" for all standard pipe sizes, they are equally well adapted to maintenance work and to new construction, whether indoors or out, above or below ground.

In addition to drop-forged steel in which they are stocked, WeldOlets and ThredOlets can be furnished in Wrought Iron, Toncan Iron, Brass, Monel, Everdur and other metals to meet every piping need.

The illustrations at the left show the ease with which they are installed. Try them at our expense. Sign the coupon below and attach to your company letterhead. It will bring you a sample and complete details.

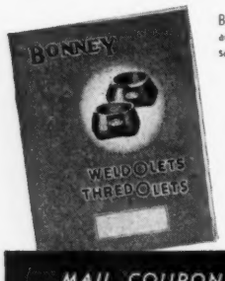
The names "WeldOlets" and "ThredOlets" are Bonney trade-marks registered in the United States Patent Office. Full patent coverage has been granted in the United States and foreign countries.

BONNEY FORGE & TOOL WORKS

Forged Fittings Division

ALLENTOWN, PA.

Stocked by Leading Distributors



Bulletin WT23 tells the complete story about WeldOlets and ThredOlets. The coupon will bring your copy and a sample trial fitting. Mail it today.

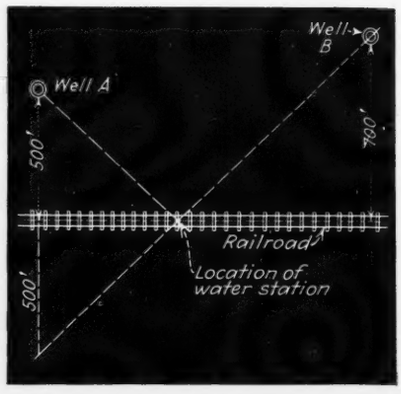
Please send me a sample WeldOlet or ThredOlet and a copy of Bulletin WT23 telling all about them. P-18

Name .....

St. & No. .....

City & State .....

MAIL COUPON TODAY →



BRAIN TESTER

Answer to problem on page 84.

It really was quite simple because the foreman remembered that old saw about a straight line being the shortest distance between two points. Taking the sketch, he measured 500 ft on the opposite side of the tracks, as shown, and drew a line between that point and Well B. Where the line crossed the tracks was the best place for the water station and that's where it went.

removing dust from the compressor inlet, and a second receiver near the point where the air is to be used, for more complete separation of oil and water.

Lakewood, Ohio J P SIMONS

Why Compress Air?

I SERIOUSLY question using compressed air for mask service for several reasons. There are a number of good separators on the market that can be installed in the air line that will remove oil and water from the air if the temperature is sufficiently low, but none that I know of will remove the odors bound to prevail. Furthermore it is poor economy to compress air to 100 lb only to use it reduced back to practically atmospheric.

I suggest using outdoor air sucked through a filter and pumped by a blower capable of delivering the required quantities against the friction of lines and equipment. Such an arrangement will supply clean air, free from odors, with a humidity at least as good as nature happens to provide, and at about 1% of the power required to pump air to 100 lb. pressure.

Bound Brook, N. J. W ROHRHURST

Engine Room Air Causing Trouble

FROM THE TROUBLE PP is having with oil and moisture in guns and masks, I believe that the atmosphere in the engine room from which air is drawn into the compressor contains an excessive amount of oil and moisture. If the oil filter is near the compressor intake, it should be moved to another part of the engine room or out of it entirely.

Also see that there is no free oil on the filter, on the compressor or on the

KOPPERS STARTS WITH SUPERIOR COAL

and keeps it so FOR YOU

Is the cost of your coal an important item in operating expense? Then the quality and uniformity of your coal have a vital bearing on your profits . . . and the care that Koppers takes to maintain such uniform quality is of vital importance to you.

Koppers *starts* with coal mined from seams known for superior quality. Strict inspection and continuous laboratory check-tests guard uniformity, day to day and car to car. You may find, as others have, that Koppers Coal permits greater boiler-room efficiency, lower boiler-room costs. Ask for details.

This laboratory scene shows one step in sulfur determination. On high volatile coal, samples are taken and tested daily . . . to be sure that the extremely low sulfur content of Koppers coal will remain so.

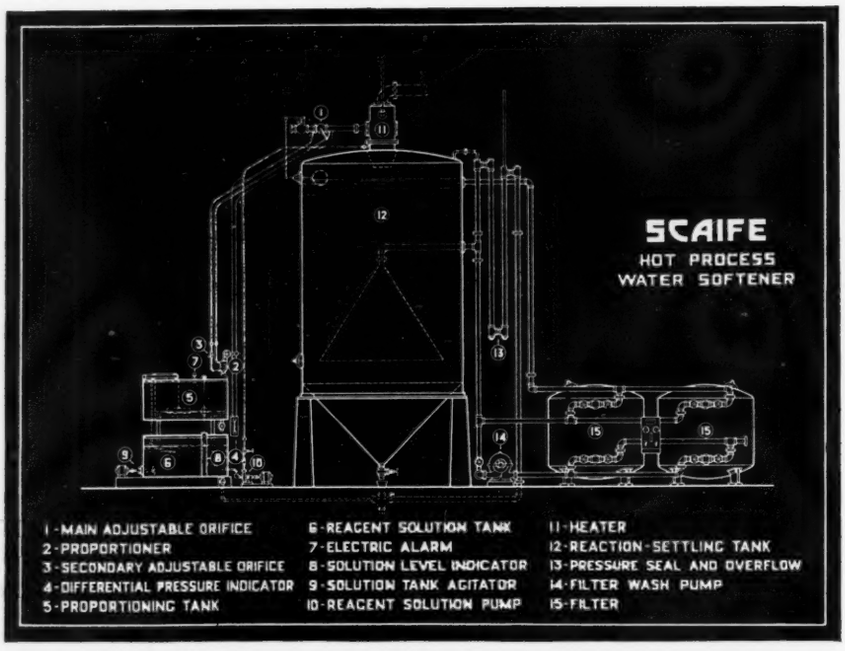
KOPPERS OFFERS THESE FAMOUS COALS

Beckley . . . Pocahontas . . . Fire Creek . . . Sewell . . . No. 2 Gas . . . Hernshaw . . . Powellton . . . Elkhorn . . . Eagle . . . Federal . . . Sonman Indian Creek

CONTROLLED **KOPPERS COAL** QUALITY

OFFICES IN PRINCIPAL CITIES

THE KOPPERS COAL COMPANY



PREPARE THE WATER OUTSIDE OF THE BOILER FOR ECONOMY'S SAKE

SCAIFE
HOT PROCESS
WATER
SOFTENER

What It Is

A Scaife Hot Process Water Softener is an external water softening device which proportionately heats, treats and filters raw water for Boiler Feed Purposes. It heats the water with exhaust steam. It treats the water with lime and soda ash. It filters the water through non-siliceous filter media.

What It Does

1. It Heats, Clarifies and Softens the Water.

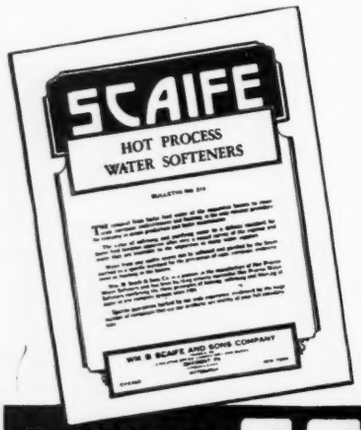
2. It Precipitates the Bicarbonates thereby lowering the alkalinity and the total solids of the water.

3. It removes Free Carbon Dioxide, Deaerates the Water and eliminates Corrosion.

In short it prepares the raw water for the Steam Boiler.

Where It Should Be Applied

A Scaife Hot Process Water Softener has its proper place among the Scaife family of water treating tools. If the raw water to be treated is hard; if most of its hardness is in the form of alkalinity; if it is turbid or acid; if it is solely to be applied to a boiler as feed water; then apply a Scaife Hot Process Water Softener. By heating the raw water prior to treating, advantage is taken of the kinetic energy within the heated water. Faster and more complete reactions, lower residual hardness and crystal clear, non-corrosive water are direct benefits. Truly a safe, sane, sure way of protecting your expensive boiler investments.



WM. B. SCAIFE & SONS CO.
OAKMONT (Pittsburgh District) PENNSYLVANIA
REPRESENTATIVES IN PRINCIPAL CITIES

engine. Have the lubricating systems tight and have no full or empty oil cans in the engine room. Next, check steam and exhaust lines for leaks; tighten stuffing boxes on valves and bolts in flanges. Also check compressor for leaks. If these suggestions are carefully followed, there should be no trouble with oil and moisture in the guns and masks.

Staten Island, N. Y. C H HUGHES

Compressed Air Is Safe

THE USE of compressed air in masks is both safe and practical, provided the installation is properly made. We have used such masks for approximately five years in connection with sandblast work. The main thing to remember is that the air is for human consumption and will have a definite effect on the life of the operators. Compressor intake must be located to furnish clean fresh air not polluted with engine-room fumes and dust. Discharge air should be cooled to approximately 70 F. Moisture traps should be installed between air line and hose connecting to the mask.

Rockford, Ill. C H PAGE

Suggests Centrifugal or Rotary Compressors

COMPRESSED AIR used in protective masks should always be free of oil and moisture. Oil rapidly deteriorates rubber parts of the mask and is both nauseating to the operator and extremely harmful to his respiratory organs. Both oil and water have a tendency to deposit on the eyepieces of the mask, beclouding vision and interfering with the quality of the work being done. Quality also suffers when the fluid used in spray guns becomes contaminated with dirt, water and oil from the air supply.

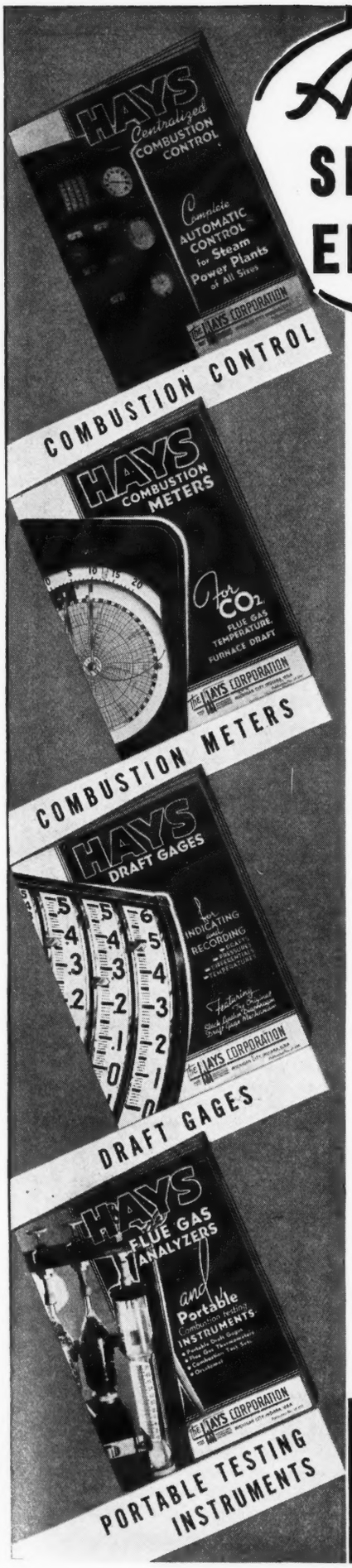
Air from ordinary reciprocating compressors is ordinarily unsuitable for these applications unless every precaution is taken to insure the removal of extraneous substances. Centrifugal rotary compressors are to be especially recommended for spray-gun and mask air supply since they require no internal lubrication. Purely centrifugal types require aftercoolers and other means of removing moisture. Rotary types using water to compress the air require nothing more than separators in the discharge line to remove entrained moisture, as the whirling water serves to cool, dehumidify and clean the air.

San Diego, Cal. J T TIERNAN

Engineers' Books

(*Continued from page* 83)

such as intake and exhaust systems, fuel-oil and oil-handling systems, lubrication, combustion, cooling systems, and air-injection systems. A particularly valuable feature of the book is a lengthy section devoted to operating difficulties; giving symptoms, causes and remedies. Various phases of maintenance are



A Complete SERVICE IN COMBUSTION EFFICIENCY AND ECONOMY

The Hays Corporation offers a complete service in boiler room instrumentation and control. For 37 years the name "Hays" has been intimately associated with combustion efficiency and economy. Through Hays research, experimentation and development work in the combustion field literally millions of fuel dollars have been saved among the industries of the world.

Hays has pioneered many of the principles involved in present day instrumentation and control. Hays instruments are noted for simplicity and practicability of design, for the care and precision with which they are made. Hays engineers devote their efforts unceasingly toward improvement, toward keeping pace with the changes constantly being made in connection with modern steam generation.

Hays engineering service is world wide. Sales and service branches in charge of District Representatives are maintained in the important cities of the United States and Canada. Branch factories are located in England, France and Germany and sales offices in the key cities of Europe, South America, Australia and Japan.

In every office you will find trained engineers whose advice on combustion matters and the selection of instruments for your plant will be of great value. You are invited to use this service freely—there is no obligation involved.

Keep your files on boiler room instruments and control up-to-date. Check the catalogs in which you are interested. Pin this coupon to your letterhead and mail to The Hays Corporation.

Write to Dept. 1-7-8

Please send me literature checked:

- ☐ Combustion Control
- ☐ Combustion Meters
- ☐ Draft Gages
- ☐ Portable Testing Instruments

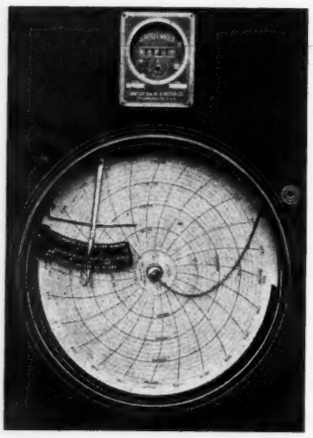
Name _____

Company _____

Address _____

The HAYS CORPORATION

SINCE 1901 — COMBUSTION INSTRUMENTS AND CONTROL — MICHIGAN CITY, INDIANA, U.S.A



Specify Simplex Meters

WHEN you require ACCURATE, SENSITIVE, WIDE-RANGE Flow Meters.

AVAILABLE to indicate, record, or totalize the flow or in any combination of these functions SIMPLEX METERS will satisfy your most rigid operating requirements.

☑ CHECK WITH SIMPLEX

SIMPLEX VALVE AND METER COMPANY
6780 Upland Street, Philadelphia, Pa.

REDUCE YOUR DIESEL PLANT INVESTMENT!

The Sterling Diesel Engine is a masterpiece of engineering simplicity. The first cost, the installation, freight, placement, depreciation, amortization and all the fixed charges are effected — downward.

STERLING HIGH DUTY

INTERNAL COMBUSTION ENGINES

135 H.P. continuous, 150 H.P. maximum, 1200 R.P.M. Sterling Diesel Engine, for direct connection to pump or generator.

(Michell Patents)

The more you know about Diesels the better can you appreciate this excellent development. Preliminary analysis of costs furnished most promptly when request is accompanied by load characteristics.

GAS • GASOLINE • DIESEL • ENGINES

STERLING ENGINE COMPANY

Home Office and Plant, 1270 Niagara Street, Buffalo, New York. Dept. C-1 Branch Office, 900 Chrysler Bldg., New York, N. Y.

presented from record-keeping to practical hints and pointers on maintenance operations. The manual concludes with a chapter on safety, and appendices giving "Recommended Practices for Internal Combustion Engines" and case histories from insurance company files.

Presentation is authoritative and up-to-date and the book should be of real value to experienced as well as younger operators.

INTERNAL COMBUSTION ENGINES (1938) —*By Howard E Degler, Chairman of Dept of Mechanical Engrg, University of Texas. Published by John Wiley & Sons, 440 4th Ave, New York, N. Y. 411 pages, 6x9 in., price $4.00.*

Intended for the reader familiar with thermodynamics and mechanics, this book treats the entire internal-combustion-engine field, comprising gas, gasoline, and oil engines. Following introductory statements on the development and application of internal-combustion power plants, the combustion of fuel and the theory of various engine cycles is presented. Chapters are devoted to gas engines, automobile and aircraft engines, vaporizing oil engines, and heavy-duty and high-speed diesels. The remainder of the book discusses details of engine design, with the exception of concluding chapters on testing and performance, and on economics of oil and gas power.

THE LABOR CRISIS IN THE UNITED STATES (1938). *By George E Sokolsky. Published by John Wiley & Sons, Inc, 440 4th Ave, New York, N. Y. Price 25 cents*—A rapid review of labor trends, policies and activities by a well-known writer on American labor.

INDEX TO ASTM STANDARDS AND TENTATIVE STANDARDS (1938). *Published by American Society for Testing Materials, 260 S Broad St, Philadelphia, Pa. Available on request*—A guide to what standard specifications, test methods, or definitions cover a particular engineering material or subject.

HEATING, VENTILATING & AIR-CONDITIONING GUIDE (1938). *Published by American Society of Heating & Ventilating Engineers, 51 Madison Ave, New York, N. Y. Price $5.00*—16th edition of well-known reference book contains 840 pages of technical data and over 300 pages of catalog data on 218 manufacturers.

PROCEDURE HANDBOOK OF ARC WELDING DESIGN AND PRACTICE. *Published by Lincoln Electric Co, Cleveland, Ohio. Fifth edition, 1012 pages, 6x9 in. 1243 illustrations. Price in U S A, $1.50*—Another edition of this practical compendium of basic information on arc welding includes new and revised information. To those familiar with previous editions, it is only necessary to state that the handbook has been brought up to the minute in every respect. For others, it contains symbols, design constructions peculiar to welding practice and many examples of how best to use welding. It is a book useful to everyone from metallurgist to welder.

(*Continued on page* 126)

In manholes or in *any* confined working space: tunnels, pipe galleries, coal pockets, process tanks, storage bins, etc., the *Cable Manhole Ventilators* (Bulletin 163).

600 cubic feet of air a minute ventilates tank cars through the nipple or manhole. Wt. 55 lbs. *The Tank Car Blower.* Ask for information.

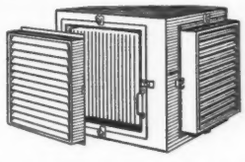
For directing a flow of cool air upon workmen (also cooling off furnaces, ventilating motors, generators, etc.) the *Heat Killer* (Bulletin 160-4).

you *PAY* for perspiration

110° F. results in only 10% normal working ability in your men. You can figure out for yourself how much work you *pay for* on hot jobs — but never get.

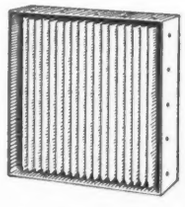
Coppus Heat Killers keep men (and jobs) cool by *directing* the air where you want it — *without recirculation.* No other type gives you that extra efficiency. Numerous sizes, all portable, deliver anywhere from 500 to 15,000 c.f.m. at high or moderate velocities.

Other Coppus air moving and cleaning equipment is listed on the column at the right. No one product is ever made for general use. Each is designed to produce *one kind* of effect . . . better than could be done by any other method. Bulletins on all Coppus Products are sent without obligation, on request. At the same time, why not outline your company's specific air needs?



★

Attached to the intake of air compressors and engines, the Coppus Air Filter provides clean air, free from abrasive dust particles (Bulletin F-310-3).



★

★

Improving working conditions, reducing dust-caused maintenance, protecting product purity, for recovering valuable airborne substances, — the Coppus Unit-Type Air Filter. (Bulletin F-320-4).

COPPUS CLEANS . . . MOVES . . . EMPLOYS AIR

There's a Coppus blower (or exhauster) to suit your plant's individual needs. Write Coppus Engineering Corporation, 350 Park Avenue, Worcester, Mass. See listing in THOMAS' REGISTER. In SWEET'S: Air Filters for air compressors, engines, and plant installations. Air moving equipment. Steam Turbines. Portable Mine Ventilation equipment.

COPPUS PRODUCTS — Designed for your industry — Engineered for you

YARWAY
GUN-PAKT
EXPANSION
JOINTS

Here is the RECORD at Large Southern Utility

First purchased Yarway Expansion Joints 7 years ago. Reordered 16 times to present total of 41 joints.

Service: 150 lbs. pressure, 75° to 100° superheat.

Maintenance Report: Never removed all old packing from any joint. Very economical of packing, time and attention. Gun-Pakt Joints repacked at will under full operating pressure by the simple twist of a wrench.

Write for catalog EJ-1906 describing the many time, labor and money saving features of Yarway Expansion Joints.

YARNALL-WARING CO.
100 Mermaid Ave., Phila., Pa.

STRAWS

Pointing the way business winds blow

ARKANSAS——Public Buildings Branch, Treasury Dept, plans central-heating plant in 2-story Ozark National Forest Service Headquarters building, Russellville. Bids will be asked soon. Cost about $155,000.

CALIFORNIA——Old Baldy Citrus Assn, Upland, plans refrigerating system in 1-story addition, 60x160 ft. Cost about $50,000. W W Ache, 301 N Citrus Ave, Los Angeles, architect.

Swift & Co plans 6-story, L-shaped refrigerating and cooler building, 144x168 ft, at meat-packing plant at Vernon, Calif. Entire project will comprise a group of multi-story buildings to cost about $1,000,000.

Board of County Supervisors, Los Angeles, will take bids soon for new generator station and water-level recorder house at San Gabriel Dam No. 1, San Gabriel. Los Angeles County Flood Control District, 751 South Figueroa St, Los Angeles, engineers.

Central California Poultry Producers Co, Santa Rosa, plans boiler house in connection with rebuilding of portion of plant recently destroyed by fire. Loss about $100,000.

Universal Consolidated Oil Co, Long Beach, plans two welded-steel pipelines from company terminal in Long Beach Harbor to site of new casinghead gasoline plant, about 3 miles inland, for gasoline transmission.

Brawley Ice Co, Brawley, plans rebuilding of portion of plant, comprising main storage building, recently destroyed by fire. Loss about $60,000. H G Craig, general manager.

Orange County Joint Outfall Sewer District, Anaheim, has approved plans for new pumping station at site for former screening plant, near Anaheim. Cost about $35,000, with equipment.

State Hospital Dept, Sacramento, contracted Alta Electric & Mechanical Co, San Francisco, at $46,640 for installation of heating and ventilating equipment in group of six new buildings at state hospital at Napa, Calif. Same company also secured award for electrical installation at $21,400.

COLORADO——La Junta has tentatively approved fund of $497,000 for new municipal electric plant. E T Archer & Co, New England Bldg, Kansas City, Mo, consulting engineer.

Bureau of Reclamation, Denver, will award contract soon for installation of ventilating and air-cooling equipment in Boulder power plant, Boulder Canyon project, Arizona-California-Nevada (Specifications 1072-D).

CONNECTICUT——Board of Education, Danbury, plans central heating plant in connection with new trade school on site at rear of State Teachers' College. Cost about $100,000. Financing through Federal aid. Harold F Dow, superintendent of schools.

New Britain is considering a municipal electric plant. Estimates of cost are being made. Proposed to arrange financing through Federal aid. George J Coyle, mayor, at head of project.

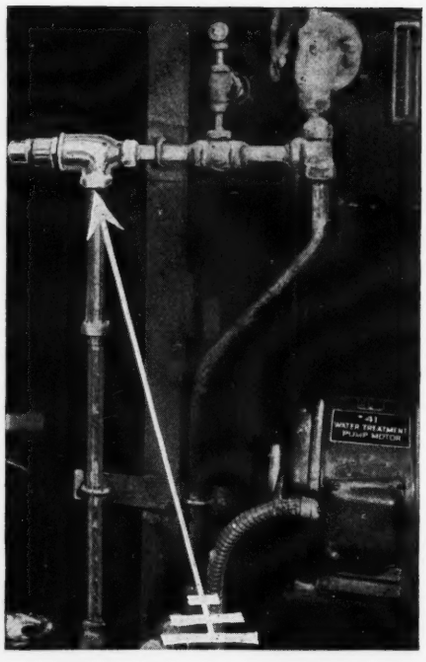
National Folding Box Co, New Haven, contracted E & F Construction Co, New Haven, for extensions in power house at factory. Cost close to $50,000 with equipment.

FLORIDA——Clearwater plans water-softening plant for municipal water system. $400,000 being arranged through Federal aid for this and other improvements, including sewage system and disposal works.

Bureau of Yards and Docks, Navy Dept, will prepare plans soon for improvements in power plant at Naval Air Station, Pensacola.

Port Everglades Refrigerating Co, Fort Lauderdale, has leased tract of land from city for expansion in cold-storage and refrigerating plant, for which plans will be prepared at once. Additional equipment will be installed.

GEORGIA——J A Beavers & Associates, Newnan, plan boiler house at 1-story meat-packing plant on local site. Cost about



CONSOLIDATED EDISON
Installs
LONERGAN HDF's

Illustration shows one of a series of Lonergan HDF's installed by Consolidated Edison Company in their Waterside Plant, New York City. Welded and operated under 1500 pounds pressure as pump relief valves on the boiler feed water treatment pumps.

The Lonergan policy of unexcelled workmanship plus a rigid factory inspection and test always guarantees satisfaction.

MODEL HDF
High Pressure Relief Valve

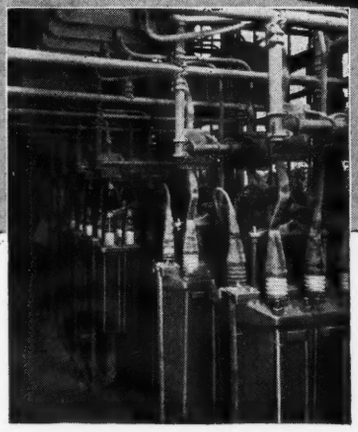
Heavy drop-forged steel body with cast steel bonnet and cap. Seats—either monel or stainless steel as specified. Suitable for high pressure hydraulic, oil or gas service. ¼" to 2". Can be furnished with exposed spring.

Specify Lonergan for trouble-free performance and long life. See your local distributor or write for new catalog.

J. E. LONERGAN CO.
SECOND AND RACE STREETS, PHILADELPHIA, PA.
300 Specialties for Power Plants
Standard Since 1872

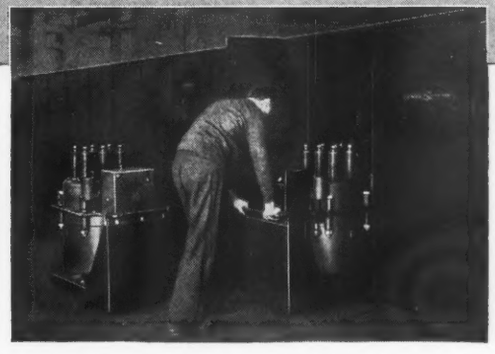
Lonergan
VALVES · GAUGES
· SPECIALTIES ·

YOU'RE LOOKING AT THE *SAFEST* SWITCHGEAR EVER BUILT

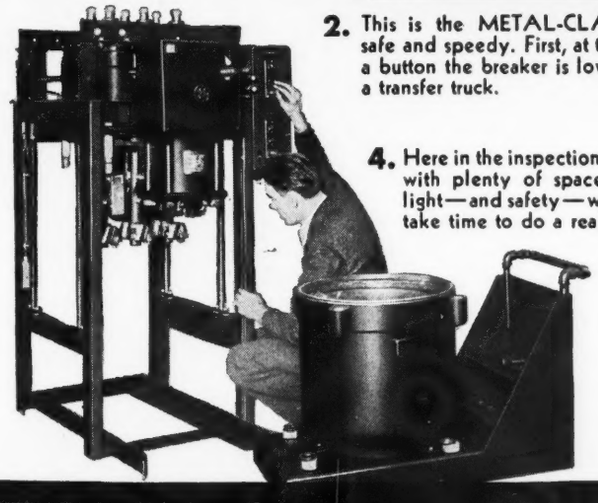


1. In the old days we had to work in among these breakers. Imagine doing a good inspection job, with safety!

2. This is the METAL-CLAD way—safe and speedy. First, at the press of a button the breaker is lowered onto a transfer truck.



3. Out she rolls and in goes a spare breaker. Then push another button and—service is restored in a few seconds.



4. Here in the inspection rack, with plenty of space and light—and safety—we can take time to do a real job.

And the production man says: Give me METAL-CLAD for increased production—lower costs. The easily removable breakers mean thorough, safe, convenient inspection without production delays.

For complete details on G-E metal-clad switchgear write for publication GEA-2499, large metal-clad, up to 15 kv, or GEA-2249, small metal-clad, up to 5 kv. General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

880-32

New "JAGABI" Universal HAND TACHOMETER

This remarkable direct-reading hand tachometer measures any speed from 30 r.p.m. up to 40,000 r.p.m. and has only three ranges—being equivalent in speed coverage to former six-range hand tachometers. The indicating pointer turns twice around the 3-inch diameter dial and over a scale which is 13 inches long—twice that of the ordinary tachometer scale. Speeds, for example, from 300 up to 4000 r.p.m. can be observed without stopping to change the range.

Operates on the well-known centrifugal principle. Accurate, dead-beat, dependable. Scale easy to read. An instrument of up-to-the-minute design and construction.

Write for new Bulletin 1575-P

The Pointer turns twice around the DIAL

We also supply other types of instruments for measuring speed, including our Frahm Vibrating-Reed Tachometers, Jagabi Speed Indicator, Jagabi Hand Tachoscope and Jagabi Hand Tachograph. Descriptive *Bulletin 1505-P* will be sent on request.

JAMES G. BIDDLE CO.
ELECTRICAL AND SCIENTIFIC INSTRUMENTS
1211-13 ARCH ST. PHILADELPHIA, PA.

ILLINOIS——Arlington Heights Farm Bureau, Arlington Heights, Ill., heads project to construct and operate a cold-storage locker building in connection with local farm bureau buildings.

Division of Architecture and Engrg, Springfield, contracted Robert Gordon, Inc, Chicago, for boiler unit and auxiliary equipment for addition to power house at Elgin State Hospital, Elgin, Ill, at $41,658; also for coal and ash-handling system to Webster Mfg Co, Bloomington, at $11,983; and for station piping to Nelson Piping Co, Rockford, at $9237.

Division of Architecture and Engrg, Springfield, has low bid from Lasker Boiler Co, Chicago, at $42,995 for boiler unit and auxiliary equipment for power house at institution at Manteno; also low bid from Alphons Custodis Chimney Construction Co, Chicago, at $13,810 for new radial brick stack.

INDIANA——St Mary's R C Parish, Huntington, will award contract soon for central-heating plant for cathedral, parochial school and other buildings, including boiler units, automatic temperature-control apparatus and other equipment. Lennox & Matthews, Architects' and Builders' Bldg, Indianapolis, architects and engineers.

Acme Engrg Co, Inc, Old First National Bank Bldg, Fort Wayne, will take bids soon for hydroelectric power development on Salomie River, near Huntington, comprising three power dams and two hydroelectric generating stations. Application has been made for Federal permission. P H Clouser is head.

Cold Keep Storage, Inc, Shelbyville, plans 1-story cold-storage and refrigerating plant, 50x75 ft. Cost about $35,000, with equipment. A locker system will be installed.

Culver Educational Foundation, Culver, plans extensions in power house at Culver Military Academy, including installation of 6250-sq ft watertube boiler and accessories, electric generator unit, 100,000-gal steel storage tank and other equipment. Bids will be asked soon. C C Chambers, secretary.

Garrett plans improvements in municipal power plant, including 5000-sq ft watertube boiler and accessories, stoker, high and low pressure piping, blast fan and miscellaneous equipment. Cost close to $40,000.

IOWA——State Board of Control, Des Moines, will award contracts soon for pumping equipment, heaters, coal-handling machinery and other equipment for power house at institution at Cherokee.

Coon Rapids will soon place contract for a 725-hp diesel unit and auxiliary equipment for municipal power station. A S Harrington, Baum Bldg, Omaha, consulting engineer.

Board of Education, Spirit Lake, plans central-heating plant at local school. Cost close to $17,000. Financing being arranged through Federal aid.

Belmond has called special election to approve bonds for $120,000 for new municipal electric plant. Financing will be arranged through Federal aid.

Board of Education, Iowa City, contracted Wheatland Co, Cedar Rapids, for heating and ventilating plants and system in high school at $71,900.

R Ray Brinton, West Des Moines, plans 1-story cold-storage and freezing plant, 30 x 64 ft. at 409 Fifth St, including locker system. Cost about $25,000.

Iowa Electric Light & Power Co, Marshalltown, has authorized extensions in gas-distributing system in Nevada St and 12th Ave, and will begin work at once.

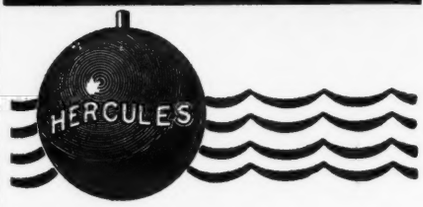
Spencer has authorized surveys and estimates of cost for extensions in municipal electric plant and waterworks station. Burns & McDonnell Engrg Co, Kansas City, Mo, consulting engineer.

KANSAS——Kansas Electric Power Co has awarded contract to Missouri Valley Bridge & Iron Works, Leavenworth, for construction of walls and waterlines, and piping installation for new power plant, Lawrence. Midwest Piping & Supply Co, St Louis, Mo, will furnish piping.

Oketo plans 25,000-gal elevated steel tank and tower in connection with new waterworks system. Financing being arranged through Federal aid. Paulette & Wilson, 1006 Kansas Ave, Topeka, consulting engineers.

Kansas Dressed Beef Co, 77 South James St, Kansas City, plans 1-story cold-storage

HERCULES
Seamless Copper
FLOATS



GUARANTEED TO STAND UP!

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

Fabricated of seamless copper under our special spinning process, Hercules Floats are uniform in thickness and high in mechanical strength.

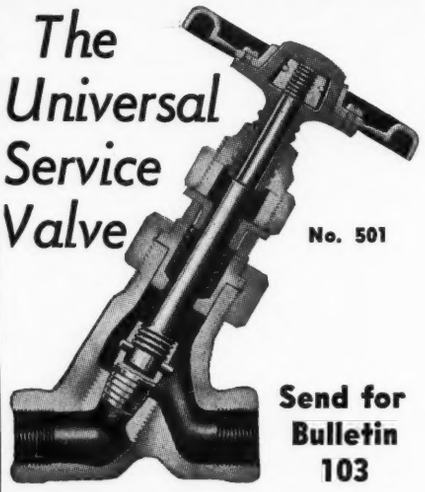
You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

Insure care-free maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

HERCULES FLOAT WORKS
200 Franklin St.
SPRINGFIELD, MASS.

MULTI-VALVE
STOP and THROTTLE
MULTI-STAGE

The Universal Service Valve



No. 501

Send for Bulletin 103

New York	Chicago	Philadelphia
11 W. 42nd St.	7 So. Dearborn	Harrison Bldg.
Boston	Kansas City	Pittsburgh
73 Tremont St.	R. A. Long Bldg.	Oliver Bldg.

The LUDLOW VALVE MFG. COMPANY
TROY · · · · NEW YORK

GULF WINS

1ST, 2ND, 3RD AT INDIANAPOLIS!

Winner Floyd Roberts averaged 117.2 M.P.H. in the 500-mile classic.

Wilbur Shaw averaged 115.5 M.P.H. to finish second.

Chet Miller averaged 114.9 M.P.H. to finish third.

Record-breaking drivers use GULFPRIDE OIL!

All three winners of the Indianapolis Memorial Day Race used—not special racing castor oils—but regular, stock Gulfpride . . . certified by the AAA Contest Board to be the identical oil sold by Good Gulf dealers everywhere!

Here's what the winners say about Gulfpride:

"Perfect lubrication provided by Gulfpride Oil played an important part in helping us win first, second, and third places in the 500-mile Memorial Day Race here at Indianapolis. Unfaltering performance of our engines throughout the gruelling race enabled us to attain faster average speeds than ever before had been achieved at this speedway."

{Signed} Roberts, Shaw, Miller

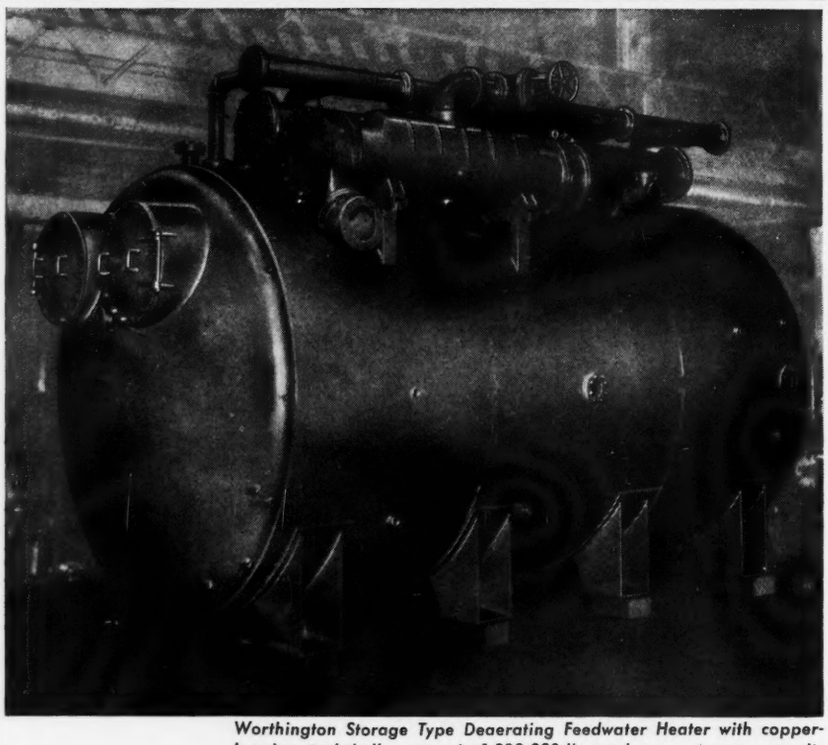
These three all-time record-smashing performances testify to Gulfpride's ability to stand up under punishment. That's why Roberts, Shaw, Miller and many other prominent racing drivers choose Gulfpride over even special racing oils. The reason is that Gulfpride is the world's only 100% Pure Pennsylvania oil refined by the Alchlor process, *in addition to* conventional methods.

This same refining process is used in the preparation of Gulf's finest industrial lubricants. Thus, operators of steam turbines, air compressors, Diesel engines and many other types of industrial equipment can secure for their engines and machines the same protection against friction, wear and repair expense that Roberts, Shaw and Miller received from Gulfpride Oil when they made three all-time records . . . Gulf Oil Corp., Gulf Refining Company, Gulf Bldg., Pittsburgh, Pa.

GULF INDUSTRIAL LUBRICATION

SAVE FUEL...

BY INCREASING BOILER FEEDWATER TEMPERATURE



Worthington Storage Type Deaerating Feedwater Heater with copper-bearing steel shell... capacity 1,200,000 lb. per hour... storage capacity 7,560 gallons. This heater... one of the largest of its type in the world ... is being installed by a prominent utility.

WORTHINGTON DEAERATING FEEDWATER HEATERS will produce the maximum obtainable feedwater temperature from the heating steam.

AIR CONDITIONING EQUIPMENT
REFRIGERATION AND ICE PLANT EQUIPMENT
AIR AND GAS COMPRESSORS
STEAM TURBINES
DIESEL ENGINES
GAS ENGINES
CENTRIFUGAL HIGH-PRESSURE BOILER FEED PUMPS
DIRECT-ACTING STEAM, POWER, AND ROTARY PUMPS
DEEP WEEL, SUMP, AND DRAINAGE PUMPS
STEAM CONDENSERS AND AUXILIARIES
STEAM-JET EJECTORS
PORTABLE COMPRESSORS AND AIR TOOLS
For street trench . conduit service
V-BELT DRIVES
LIQUID METERS

•

Literature on request

Also... **by removing free oxygen from the feedwater...** *they*

- Increase boiler efficiency.
- Reduce boiler repairs.
- Reduce boiler cleaning.
- Prolong life of both boiler and piping.

WORTHINGTON Feedwater Heaters are built to meet individual plant requirements. There is a type and size for every condition... and the services of experienced Worthington engineers are available for a study of any feedwater problem.

WORTHINGTON PUMP AND MACHINERY CORPORATION
General Offices: **HARRISON, NEW JERSEY**
Offices and Representatives in Principal Cities

SH8-3

St, Kansas City, plans 1-story cold-storage and refrigerating plant addition, 39 x 45 ft. Cost about $30,000, with equipment.

KENTUCKY——Danville plans water tower for municipal water system. Cost close to $25,000. Fund will be secured from an appropriation of $95,000 for municipal improvements, to be financed through Federal aid.

LOUISIANA——St Francisville has called special election on July 12 to approve bond issue of $25,000, for installation of a municipal natural-gas distributing system.

Houma plans extensions in municipal electric plant, including diesel-generator unit and accessories.

Thibodaux will place contract soon for two 500-gpm, motor-driven pumping units and auxiliary equipment for sewage-pumping station. J B McCrary Co, Inc, Atlanta, Ga, consulting engineer.

Caddo Parish School Board, Rodessa, plans central-heating plant in multi-story high school. $300,000 is being arranged. Proposed to begin work early in fall.

MASSACHUSETTS——Boston Edison Co. in connection with improvements at Edgar Station, has purchased a Worthington centrifugal feed pump with a capacity of 700,000 lb per hr against a discharge head of 1790 lb per sq in. The pump will be direct driven by a 1750-hp, 2300-volt General Electric induction motor at 3600 rpm. Watertown is considering municipal electric plant. Estimates of cost will be made soon.

Springfield contracted Fred T Ley & Co, Inc, Springfield, for four large pumping stations for municipal sewerage system. Metcalf & Eddy, Inc, Statler Bldg, Boston, consulting engineer.

MICHIGAN——Montrose plans municipal pumping station in connection with new water-supply system. Francis Engrg Co, Saginaw, consulting engineer.

Hancock plans extensions in former building used for municipal power house, to be converted for a municipal cold-storage and refrigerating plant. Cost about $40,000 with equipment. Albert L Ehler, city engineer.

Socony-Vacuum Oil Co, 903 W Grand Blvd, Detroit, has approved construction of 8-in. steel pipeline from waterfront on lakeside, Muskegon, to bulk storage plant in city for gasoline transmission from tankers.

Board of Water and Light Commissioners, Lansing, contracted Reniger Construction Co, Lansing, at $278,296 for installation of a water-softening plant for municipal waterworks.

MINNESOTA——Halsted is arranging early special election to vote bonds for $40,000 for new municipal power plant. Ealy G Briggs, 1957 University Ave, St. Paul, consulting engineer.

Keewatin plans extensions in municipal steam-heating plant and system, including new equipment. $55,000 authorized.

MISSISSIPPI——Greenwood Light and Water Commission, Greenwood, contracted Combustion Engrg Corp, for boiler units and auxiliary equipment for municipal power plant, at $54,000. Also let contract to American Engrg Co, for stoker installation at $26,000.

Robert Vincent, Clarksville, plans boiler house at new one-story meat-packing plant on Fourth St. Cost about $30,000.

MISSOURI——Chillicothe made following awards in connection with its new municipal power-plant addition: building, Ebbe Construction Co; boilers, Henry Vogt Machine Co; switchboard and generator set, Barr-Thorpe Co; cooling tower, Lilie-Hoffman, Inc.

Carrollton is considering report made by Burns & McDonnell Engrg Co for municipal electric plant to cost $235,000. Financing will be arranged through Federal aid.

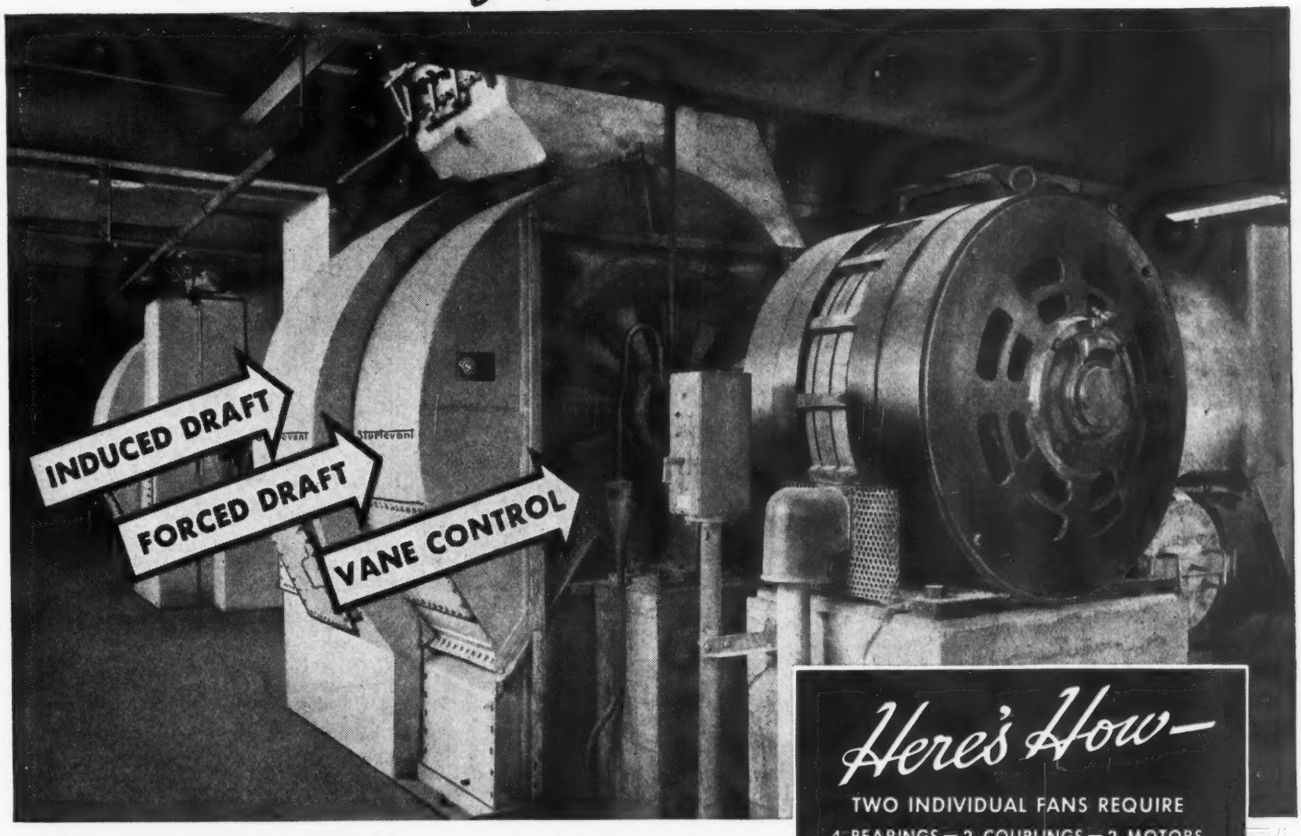
La Plata will award contracts soon for two 300-hp diesel-generator units and auxiliary equipment for municipal electric plant; also for cooling tower, oil storage tanks and accessory equipment. E T Archer & Co, New England Bldg, Kansas City, consulting enigneers.

NEBRASKA——Lincoln plans improvements in municipal electric plant, and will arrange $175,000 through Federal aid. D L Erickson, city engineer.

Blue Creek Public Power & Irrigation District, Lewellen, plans hydroelectric power plant and irrigation project, includ-

Sturtevant DUPLEX Draft Fans save Hammermill Paper Company

Space! Equipment! Money!



Sturtevant Duplex Mechanical Draft Fans installed at Hammermill Paper Company, Erie, Pa.
Consulting Engineers: Stone and Webster Engineering Corporation

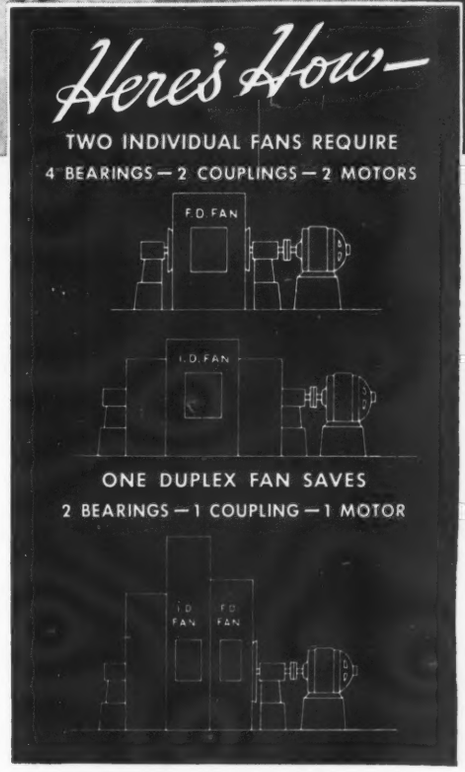
THERE ARE actually *two* Induced Draft Fans and *two* Forced Draft Fans in the above installation at the Hammermill Paper Company, Erie, Pa. Four fans—but only *two* fan units! Notice to the right, what this means in equipment savings! In fact, when you install a Sturtevant Duplex Draft Fan you get six outstanding advantages:

1. **Fan cost reduced, compared to separate fan units.**
2. **Less floor space required. Foundation cost lowered.**
3. **Only one motor needed—motor and wiring control cost reduced.**
4. **One coupling, two bearings and two pedestals eliminated.**
5. **Duct system simplified.**
6. **Automatic load adjustment* with Vane Control.**

Recent installations: Standard Oil Co. of Southern California, Consolidated Edison Co. of N.Y., Virginia Electric and Power Co., Tampa Electric Co., Spreckels Sugar Co., Richfield Oil Co., Pacific Gas and Electric Co., Louisiana Steam Products Co.

Write for complete information.

B. F. STURTEVANT CO., Hyde Park, BOSTON, MASS.
Branches in 40 Cities B. F. Sturtevant Co. of Canada, Ltd.—Galt, Toronto, Montreal



***Patent Applied For**

DRAFT FANS · TURBINES · GEARS · ECONOMIZERS · AIR HEATERS

Courtesy of Worthington Pump and Machinery Corp.

ease in pump assembly

Quick precision adjustment of reciprocating pump bearings and gear shaft, for example . . . By simply peeling the paper-thin laminations from the solid brass Laminum shim. Right at the job . . . in assembly AND service adjustment! No filing, no machining. Write for Laminum sample (.002 or .003 in. laminations).

LAMINATED SHIM CO., INC. 21-60 44th Ave., Long Island City, N. Y.

Cleveland Detroit Milwaukee

933

LAMINUM

Precision adjustment **SHIMS**

FYR-FEEDER

BURNS CHEAPEST COALS CUTS COAL COST

Fyr-Feeder is slashing coal costs for power plant operators because it successfully burns the cheapest screenings — minus ⅛"—minus ¼"—bug-dust—or any screenings up to 1½"—wet or dry.

Fyr-Feeder has further money saving advantages—lower operating costs—flexible operation — steady steam pressure — increased boiler capacity. Reduces banking losses—eliminates expensive maintenance.

Data sheet No. 41 shows how four Fyr-Feeder equipped plants have made savings averaging 31.7% even though all four plants previously had stoker equipment. Write for your copy of this interesting sheet and bulletin 77 which describes the Fyr-Feeder in detail.

AMERICAN COAL BURNER CO.

FOUNDED 1918

167 EAST SUPERIOR STREET, CHICAGO

If this isn't your own copy of **POWER . . .**

. . . may we point out that occasional reading holds both benefit and risk.

Benefit for you as a responsible power engineer or executive, because POWER articles and news are always helpful and informative.

But there's risk too in reading copies of POWER that you *only* see by chance. You can so easily miss an issue containing the very feature article you need to help you on some immediate problem.

To be sure that you receive promptly all the big, practical issues of POWER . . . to profit by the value of regular, thorough reading, enter a personal subscription.

Simply address:
POWER, 330 West 42d Street, New York, N. Y.

RATES In United States and Canada, $3 a year, Two years, $4. (Elsewhere, $6 for one year, $9 for two years.)

ing series of motor-driven pumping stations for irrigation water. $660,000 being arranged through Federal loan and grant. Parson, Klapp, Brinkerhoff & Douglas, 142 Maiden Lane, New York, N. Y., consulting engineers.

NEW HAMPSHIRE——Gonic Mfg Co, Gonic, plans extensions in power plant at textile mill, including new generator unit and auxiliary equipment, and 50,000-gal tank. Cost over $75,000.

NEW JERSEY——Delaware, Lackawanna & Western Railroad Co, Hoboken, plans electric-operated coaling station at terminal at Elmira, N. Y. Cost close to $35,000.

Rossotti Lithographing Co, Inc, plans complete air-conditioning system in new plant at North Jersey Industrial Terminal, with equipment. North Bergen. Cost close to $100,000.

NORTH CAROLINA——Hoover Hill Gold Mine, Asheboro, plans early rebuilding of boiler plant at gold-mining properties near city, recently destroyed by fire.

Archdale-Trinity Sanitary District, High Point, George B Craven, chairman, plans installation of motor-driven pumping machinery and auxiliary equipment, and two elevated steel tanks and towers. $172,000 being arranged through bond issue and Federal aid.

Bethel Mfg Co, Tarboro, plans early rebuilding of boiler house at local lumber mill, recently destroyed by fire.

Ecusta Paper Corp plans power house at new pulp and paper mill for cigarette-paper production on site near Brevard. Work will begin this summer. Cost about $2,000,000. J E Sirrine & Co, 215 Main St, Greenville, S. C., are consulting engineers.

Newton is considering municipal generating station and will secure estimates of cost in near future. Edward Haupt, mayor, is head of project.

University of N. C., Chapel Hill, contracted Carolina Heating & Engineering Co, Durham, for installation of heating and refrigerating systems in new public health and medical building at institution, at $43,400. Also let contract to Mill & Marine Electric Co, Gastonia, at $16,475 for electrical installation. Structure will cost over $300,000. Wiley & Wilson, Peoples' National Bank Bldg, Lynchburg, Va., mechanical engineers.

OHIO——Middletown Hospital Assn, Middletown, plans extensions in boiler plant at hospital. Bids will be asked soon. Fosdick & Hilmer, Union Trust Bldg, Cincinnati, consulting engineers.

Alliance Cold Storage & Packing Co, Alliance, plans rebuilding of portion of plant recently destroyed by fire. Loss about $30,000, with equipment.

Middletown is making surveys and estimates of cost for a municipal electric plant. Walter J Braun, city manager in charge. L P Diefenbach, city engineer.

Toledo plans two or more large electric-operated pumping stations for new water supply system from Lake Erie. Project also will include a 12,000-ft intake tunnel in lake; 78-in. main water supply line, 12 miles long; and new filtration plant with capacity of 64,000,000 gnd. Cost about $8,000,000. Financing will be arranged through Federal aid. George N Schoonmaker, chief engineer of water department.

Sandusky will vote on proposition for proposed municipal electric plant at primary election in August, estimated to cost about $1,500,000. Financing will be arranged through Federal aid.

Board of Public Affairs, Lebanon, is considering improvements in municipal electric plant.

OREGON——Klamath Ice & Storage Co, Klamath, plans extensions in building now occupied by Pacific Fruit & Produce Co, and will convert for expansion in cold storage division, with installation of new equipment. A new 1-story building will be erected for last noted company, 150 x 150 ft, to cost over $50,000. A M Collier is general manager.

Pendleton Co-operative Assn, Pendleton, has approved plans for improvements in cold-storage plant, including additional equipment.

SOUTH CAROLINA——Southern Kraft Corp, Georgetown, contracted Rust Engrg Co, Clark Bldg, Pittsburgh, Pa., for new stack, 250 ft high, at power house at local pulp and paper mill, to replace a group of five existing stacks.

INSULAG

(REG. U. S. PAT. OFF.)

for Insulating Boiler Walls

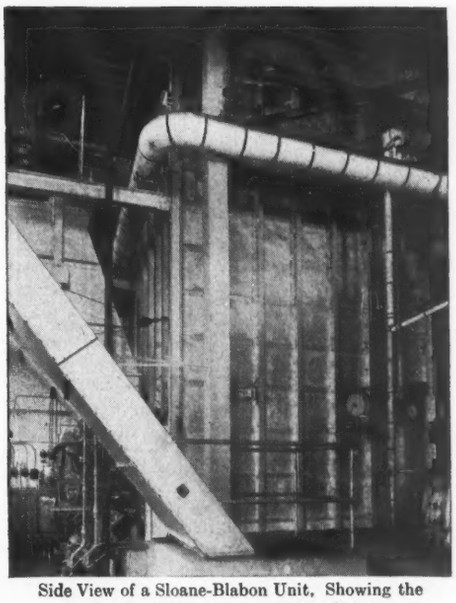
INSULAG seals and insulates walls of two new Edge Moor Boilers at Sloane-Blabon Corp., Philadelphia, Pa. Each has maximum continuous rating of 40,000 lbs. of steam per hour; and maximum 4 hour rating of 50,000 lbs. of steam per hour. Boiler heating surface of each unit, 3880 sq. ft.; water walls 509 sq. ft.; stoker water cooling, 68 sq. ft.

INSULAG is applied over 7½-in. fire brick blocks. Vertical wall areas (2750 sq. ft.) covered with 3-in. INSULAG. All top areas (300 sq. ft.) covered with 2½-in. INSULAG. On outside sidewall of 2-ft. panel areas, the temperature readings at still air ranged from 108°F. to 194°F. Ducts, casings and drums also covered with INSULAG. The INSULAG coat is free from shrinkage and cracks. Has a smooth, white surface.

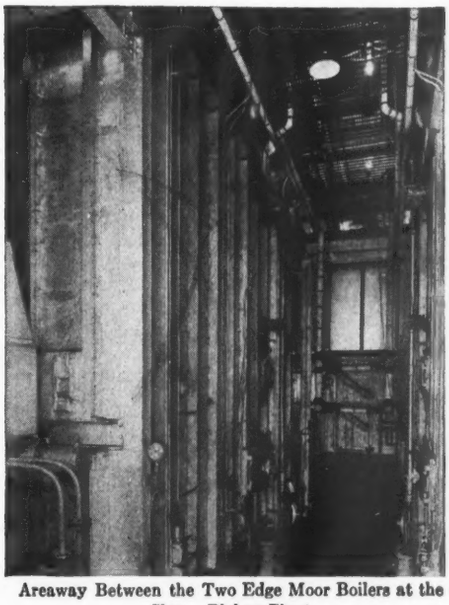
INSULAG is a superior refractory lagging for temperatures up to 2200°F. Unsurpassed insulating properties—high mechanical strength! Can be applied on hot or cold surfaces of flues, ducts, drums, etc. Also on refractory brick and concrete. Makes a finishing coat for other types of insulation. Is not affected by steam or moisture. Does not shrink when drying. Expands—an inch applied is more than an inch when dried. Retains this increased volume throughout entire range of service temperatures. Does away with air spaces between lagging and hot surfaces. A trowelled finished job has a beautiful, smooth, white surface. Retains practically constant insulating values throughout its service range. Under varying conditions and temperature changes there is no appreciable loss of insulating efficiency.

Unusually low heat storage and thermal conductivity make INSULAG a most effective insulator. Permits reduction in thickness of heavy fire brick walls. Decreases heat capacity of total refractory structure. RESULTS IN LARGE FUEL SAVINGS—INCREASED EFFICIENCIES.

Send for Bulletin 327 PM



Side View of a Sloane-Blabon Unit, Showing the Perfect Surface of an INSULAG Job.



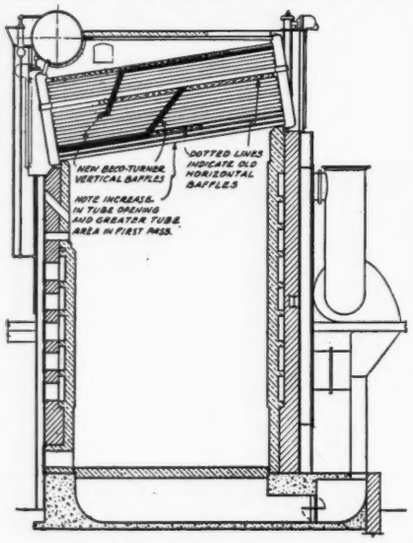
Areaway Between the Two Edge Moor Boilers at the Sloane-Blabon Plant.

QUIGLEY COMPANY, INC.
56 W. 45 ST., NEW YORK, N. Y.

Makers of HYTEMPITE *"The World's Standard High Temperature Cement"* · SPECIFICATION FIRE BRICK · INSULBRIX INSULBLOX · INSULCRETE · Q-CHROMASTIC · Q-CHROME · HEARTH-CRETE · CAST-REFRACT · MONO-LINE ACID-PROOF CEMENTS · QUIGLEY REFRACTORY GUN · TRIPLE-A PROTECTIVE COATINGS · Q-SEAL · DAMIT *ANNITE*

Distributors with Stocks and Service in Important Industrial Centers Throughout the United States, Canada, and in 32 Other Countries.
In Canada, Quigley Company of Canada, Limited, Lachine, P. Q.

SLAGGING *Eliminated*


NEW BECO-TURNER VERTICAL BAFFLES
DOTTED LINES INDICATE OLD HORIZONTAL BAFFLES
NOTE INCREASE IN TUBE OPENING AND GREATER TUBE AREA IN FIRST PASS.

by BECO-TURNER Baffle Walls

THE print above shows a 720 hp. wood-burning boiler serving a prominent Michigan automobile plant. As originally installed, this boiler was equipped with horizontal baffles, and it was necessary to shut down the boiler every two weeks to remove slag accumulations on the tubes.

Recently Beco-Turner vertical baffles were installed, as indicated above, and the slag problem disappeared. Because Beco-Turner baffles are properly proportioned to give uniform gas velocity throughout all passes of the boiler, slagging is reduced to a minimum. This boiler can now be operated indefinitely without the necessity of slag removal.

Other benefits have been increased rating, reduced fuel consumption, and decreased furnace maintenance. These results are typical of the improvements effected by Beco-Turner baffles.

Let us quote on Beco-Turner baffles for modernizing existing boilers or for new units. Send blueprints for our recommendations and proposal.

Plibrico Jointless Firebrick Co.
Nation-Wide Boiler Setting Service
Baffle Dept., Chicago Ill.

MAIL COUPON FOR FREE CATALOG
Plibrico Jointless Firebrick Co.
1818 Kingsbury St., Chicago, Ill.
Please mail copy of Beco-Turner catalog

Firm .....
Address .....
Name ..... **Title**.....
.....
Send blueprints for baffle recommendations

SOUTH DAKOTA——Flandreau contracted Worthington Pump & Machinery Corp. at $77,975 for two diesel engine units and auxiliary equipment for municipal power plant. Also let contract to Electric Engrg & Construction Co, 1225 Walnut St, Des Moines, Iowa, for switchboard equipment and improvements. Buell & Winter Engrg Co, Insurance Exchange Bldg, Sioux City, Iowa, consulting engineer.

TEXAS——Groesbeck plans 150,000-gal. elevated steel tank and tower, and filtration plant with capacity of 600,000 gpd. Cost over $100,000. Hawley, Freese & Nichols, Capps Bldg, Fort Worth, consulting engineers.

Hamman Exploration Co, Gulf Bldg, Houston, contracted Western Supply Co, Tulsa, Okla., for new gasoline-extraction plant at Bay City, to include air compressors, boilers and other mechanical equipment. Cost close to $100,000.

Houston Chronicle, Houston, plans air-conditioning system in printing and publishing plant at Texas and Travis Sts, in connection with remodeling and improving structure. Cost over $350,000.

Atlanta plans boiler house at new municipal canning plant, for which work will begin soon. Cost close to $35,000, with equipment. C H Leinbach, North Texas Bldg, Dallas, architect.

Interstate Theaters, Inc, Majestic Bldg, Dallas, plans air-conditioning plant and system in Palace Theater, McAllen. Bids are scheduled to be asked soon.

Cameron plans filtration plant for municipal water system. Bond issue of $150,000 has been arranged for this and pipeline installation for water distribution. Joseph J Rady, Majestic Bldg, Fort Worth, consulting engineer.

VIRGINIA——Dixie Container Corp, Richmond, plans boiler house at corrugated container-manufacturing plant. Entire project will cost over $75,000. Charles A Felvey is vice-president.

F S Royster Guano Co, Royster Bldg, Norfolk, plans power house and pumping station at new commercial fertilizer plant at Indianapolis, Ind. Cost over $450,000. E C Doeppers, 134 E Market St, Indianapolis, Ind., consulting engineer.

Lynchburg Hotel Corp, Lynchburg, plans air-conditioning system in part of local Virginia Hotel, in connection with remodeling and improving structure. Cost close to $30,000.

WASHINGTON——Bureau of Yards and Docks, Washington, D. C., plans extensions and improvements in power plant at Puget Sound Navy Yard, Bremerton, to cost $450,000, with equipment.

Washington Frosted Food Co, 71 Columbia St, Seattle, plans cold storage and refrigerating plant in new vegetable freezing plant at Elma, Wash. Cost over $100,000.

Shell Oil Co, North 111 Greene St, Spokane, has filed plans for boiler house at local bulk oil terminal, to include a 750-sqft boiler and auxiliary equipment. Cost about $25,000.

WEST VIRGINIA——Pursglove Gas Coal Corp, Pursglove, contracted United Engineers & Constructors, Inc, Philadelphia, Pa., for new tipple and coal-screening plant at No. 5 mine, near Pursglove. Cost about $100,000.

WISCONSIN——Nunn-Bush Shoe Co, 2822 5th St, Milwaukee, plans power plant at shoe factory. Site is being acquired. Cost close to $55,000. Oscar A Kisa, 2932 N Newhall St, Milwaukee, engineer.

Edward Pauls, Sturgeon Bay, plans 1-story cold-storage plant, 55x84 ft, and will begin superstructure at once. Cost about $25,000, with equipment. G J Feldhausen, 1464 Elm St, Green Bay, architect.

Oconomowoc Canning Co, Sun Praire, contracted Central Construction Co, Medford, for power house, 40x60 ft, at canning plant, and will install boilers, pumps and auxiliary equipment.

Cutler-Hammer, Inc, Milwaukee, Wis., contracted H Schmitt & Son, Inc, Milwaukee, for alterations and improvements in boiler house at electrical-equipment-manufacturing plant.

WASHINGTON, D. C.——Woodward & Lothrop, 10th and F Sts, N W, department store, will install boiler plant in 6-story warehouse and distributing building on M St, N E, 250x260 ft. Cost close to $1,000,000. Abbott, Merkt & Co, 10 E 40th St, New York, N Y, engineers.

Engineers' Books

(*Continued from page* 116)

KENT'S MECHANICAL ENGINEERS' HANDBOOK—DESIGN, SHOP PRACTICE (11th Edition—1938). *Published by John Wiley & Sons, Inc, 440 Fourth Ave, New York, N. Y. 1378 pages, 5 x8⅝ in., semi-flexible binding. Price $5.*

A companion volume to the "Handbook of Engineering Fundamentals" and "Power", "Design, Shop Practice" is the third and last volume of the handbook series dealing with mechanical engineering. The chapters have been extensively revised and much new material added. Users of earlier editions would do well to consider replacing them with the new volumes of the series, now complete.

BOILERS, SUPERHEATERS, ECONOMIZERS, AIR HEATERS AND PIPING. *Published by Edison Electric Institute, 420 Lexington Ave, New York, N. Y. Price 90 cents to members and their employees; $2.35 to non-members*—Contains reports by sub-committees and manufacturers on operating and design problems, including boiler outages, recent designs and installations.

CABLE OPERATION, 1936. *Published by Edison Electric Institute, 420 Lexington Ave, New York, N. Y. Price 60 cents to members and their employees, $1.50 to non-members*—Survey of data obtained from 59 companies on underground power systems operating at more than 7.5 kv. Trouble rates broken down and charted.

ELECTRICAL MACHINERY (4th Edition—1938). *By Terrell Croft, consulting electrical engineer. Revised by George H Hall. Published by McGraw-Hill Book Co, Inc, 330 W 42nd St, New York, N. Y. 394 pages, 5½x8 in., 356 illustrations. Price $3.00.*

This is the fourth edition of a book first published in 1917 and deals with principles, operation and maintenance of electrical machinery. Since the third edition was published in 1929 there have been many improvements in design of electrical machinery and a constant development in applications of power to machines and processes.

Much new material has been added and considerable of the old revised or removed entirely. Whereas the first edition contained 318 pages, the present one has 394. The former chapter on induction motors has been divided into two, which cover respectively induction motors and single-phase motors. The more recent expansion in design and application of multi-speed motors has been included and considerable material added on mercury-arc power rectifiers. The final chapter of the original edition dealing with electric elevators has been replaced by one dealing with special types of motors and one on motor applications. Terminology and practices have been made to conform with standards of the National Electrical Manufacturers Assn and the 1937 National Electrical Code regulations.